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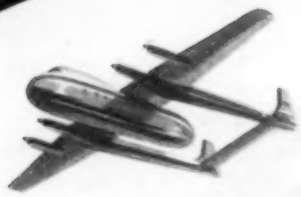

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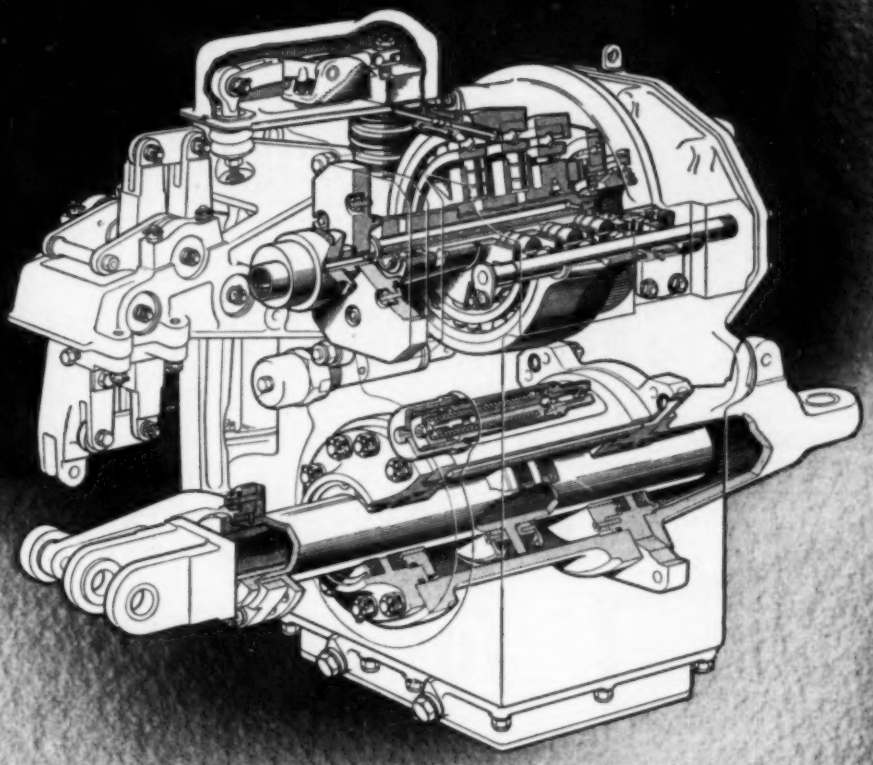

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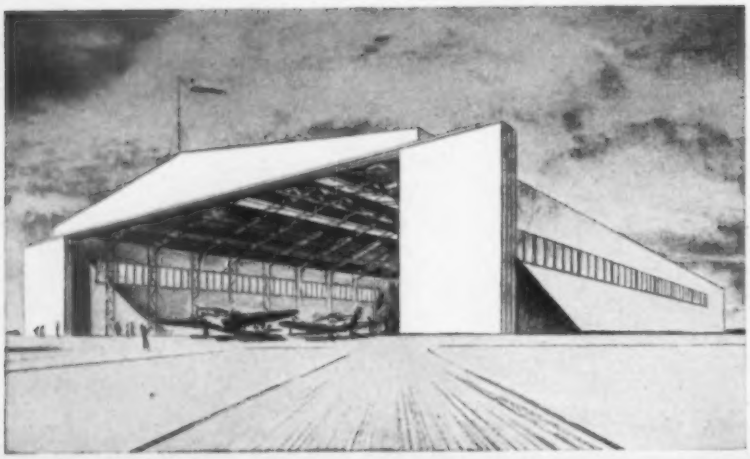

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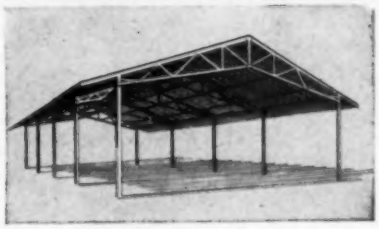

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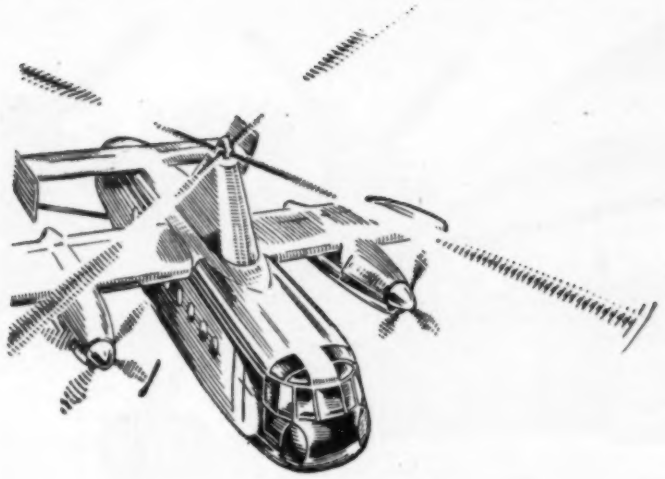

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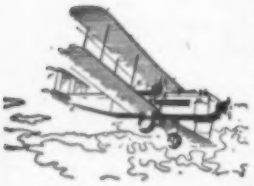

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

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A Pointer to Profit

IT is just a year since the world's airlines agreed to introduce a new low level of North Atlantic fares. Traffic growth had been slowing down and it was imperative to penetrate fresh markets if capacity was to be filled. Many airlines were unhappy about reducing fares. Profit margins would, they feared, fall if the market failed to respond.

These fears are now proved unjustified: the number of people flying the Atlantic has risen this year by no less than a quarter—at a time when traffic elsewhere is in the doldrums. Unfortunately, capacity has increased even more rapidly, and this has led to a fall in profits. But without the new fares the position would have been even worse.

Credit for the economy-class idea must go to Pan American and to the U.S. Civil Aeronautics Board: only their determined pressure overcame the opposition of the hesitant and fearful. When the low-fare school won the day, in December 1957, *Flight* prophesied that "the C.A.B. will before long be applauded rather than pilloried for its dogged protection of the consumer." At that time the British Ministry of Transport supported B.O.A.C.'s opposition to the proposed cheap fare. But today the Minister says that "the right policy for civil aviation is a low-fares policy"—and he rejoices in the "success of economy-class operations."

The moral to be drawn from economy-class experience is clear: low profit-margins are no reason for obstructing fare reductions. How often do we hear airlines say: "We cannot afford to reduce fares." North Atlantic experience suggests that they cannot now afford to delay the extension of economy services to other routes.

The Navy's Air Dimension

TWENTY-ONE years ago the Fleet Air Arm was placed under Admiralty control. This anniversary was to have been celebrated by a reunion at the Royal Albert Hall next Monday (December 1) but the event was postponed because many of the carriers, and with them their operational aircrew, would be away from home waters. Postponement, however, does not prevent all who wish the Arm well from paying it respectful and affectionate greetings.

The F.A.A., as the Service that we know today, had a rather pedestrian inauguration in an announcement by the Prime Minister (Mr. Neville Chamberlain) in July 1937 that ". . . in the case of the Fleet Air Arm the Government consider that these ship-borne aircraft should be placed under the administrative control of the Admiralty."

Most people know the story thereafter. How the F.A.A. found itself indifferently equipped at the outbreak of war. How, through its valour and determination, this scion of the Royal Navy quickly won glory in battle: at Taranto; in the *Bismarck* action; in the pursuit of *Scharnhorst* and *Gneisenau*; in defence of the Malta convoys; and in many other deeds of hardly less renown. How in the post-war truce it has showed its mettle in Korea and in other theatres.

Having so fully earned the right to operate them, the F.A.A. is now receiving aircraft as good as any in the world for their specialist tasks. The public saw the R.N. Supermarine Scimitars for the first time at Farnborough this year; a flight of de Havilland Sea Vixens is working up; the mettle of Naval helicopters—Westland-built—was proved at Suez; the anti-submarine Fairey Gannet is being followed up with an early-warner; Blackburn's NA.39 promises a new accession of power to the Naval air dimension. The carriers are being progressively modernized, and the U.S. Navy has adopted the British deck-landing aids.

So this anniversary falls at a truly auspicious time for the Fleet Air Arm: its potential as part of our mobile striking forces has never been greater.

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FROM ALL QUARTERS

State of the Industry

BEYOND confirming that twenty Britannias were on order, the Minister of Supply (Mr. Aubrey Jones) had no information to give when asked in the House of Commons last Monday about new transport aircraft for the R.A.F.

When Mr. de Freitas (Lab., Lincoln) asked Mr. Jones if he would "remind the Air Minister that there is no replacement on order for the Valetta or the Beverley" and that "this continued delay" was "giving great pleasure to the American aircraft industry and causing great concern to the British," Mr. Jones said that Mr. Freitas should address the Air Minister, adding: "I can only place orders to requirements by the Services."

In the Commons last week Mr. R. A. Butler, Leader of the House, said he could not promise a debate on the aircraft industry before Christmas. He was replying to a motion tabled by three Conservative back-benchers urging the Government to make capital available to the aircraft industry to prevent the sale to foreign powers of outstanding new aeronautical inventions.

Redundancy at the Prestwick factories of Scottish Aviation, Ltd., where in the past two months 798 of the 2,400 workers have been declared redundant, was expected to be reduced by a Ministry of Supply order last week for four more Twin Pioneers. Mr. T. D. M. Robertson, the general manager, said that the third redundancy list—of 370 names—would be cut by at least 50. About 1,600 men at the D.H. factory at Broughton, Chester, are to go on a shorter (44-hour) working week; and Mr. G. W. Hall, chairman and managing director of Fairey Aviation, said at its annual general meeting (reported below) that there was a possibility of "major redundancy" on the aircraft side of the company.

Fairey Chairman's Outspoken Review

SOME sharp observations on conditions in the aircraft industry were made by Mr. G. W. Hall, chairman and managing director of Fairey Aviation, at the company's annual general meeting on November 20. He said that the industry's activities had "turned a complete somersault." Whereas a few years ago factories were working at high pressure to meet "the then urgent" Government requirements, "we now face a complete reversal where, as a result of the White Paper on Defence and Government policies, we have the resources on our hands but insufficient work to utilize all our facilities."

Mr. Hall went on to say that "this abrupt change," added to the fact that in the civil field the industry had to be self-supporting and to compete with foreign government-subsidized industries, had created a situation not only full of imponderables but also full of difficulties to resolve—owing to "the lack of clarity with regard to the ultimate intentions of the Government concerning the industry."

He added that if the aircraft industry were to continue it must maintain the expensive research and development facilities necessary for design and production. A Government policy which refused to accept the need to support such facilities must, of necessity, also accept that this would inevitably mean the withering-away of this country's entire future in the air.

AT THE BLOODHOUNDS' KENNEL: On November 19, as related on page 840, Prince Philip visited R.A.F. North Coates, base of the first squadron (No. 624 Air Defence Missile Sqn.) to be equipped with Bristol Bloodhound ground-to-air missiles. His Royal Highness is seen with (l. to r.) A.V-M. H. P. Fraser, A.O.C. No. 12 Group, Fighter Command; G/C. J. Leathart (station commander); and Air Chief Marshal Sir Thomas Pike, A.O.C-in-C. Fighter Command. The whole sequence of firing was demonstrated to Prince Philip, who also flew across the Humber by R.N. Whirlwind to visit R.A.F. Patrington

Mere grouping would not affect this situation; if the entire research and development costs of new and novel ideas were to be borne by sales of aircraft to civil operators, such aircraft could not be sold at prices which could compete with aircraft of other countries whose costs had been borne by military or similar government orders. "We can only hope that reason will prevail and support be given to the research and development projects necessary to keep this country in the forefront of aviation."

Referring to his own company, Mr. Hall said that Fairey felt justified in claiming that its recent record of technical achievement was unsurpassed by any other aircraft company. The F.D.2 continued to emphasize its outstanding supersonic qualities; the Gannet AEW.3 had recently undergone initial carrier trials; the Ultra-Light had given first-class performance on trials and development was continuing for a C. of A. No additional orders had been placed, however, for Fireflash and the company was forced now to regard this project as at an end.

Of the Rotodyne, Mr. Hall said that flying had continued most successfully and performance results had exceeded expectations. Considerable interest had been shown in it by airline operators and by the U.S. armed forces and an agreement for its manufacture in the U.S.A. had been made with Kaman Aircraft Corporation. No final reply, however, had yet been received from the Ministry of Supply—after protracted negotiations—about a share in the development costs. "We cannot, after this long delay," said Mr. Hall, "be entirely hopeful as to the eventual outcome." [See "Support for the Rotodyne?" p. 842.]

As reported in *Flight* on October 31, Fairey's consolidated group trading profit for the year ended March 31 was £2,231,146, a slight increase over the 1956-57 figure.

A.W.A. Replicas

SCALE models of two famous former R.C.A.F. aircraft, the Armstrong Whitworth Siskin and Atlas (see accompanying photograph), were being presented to the Canadian High Commissioner, Mr. George Drew, in London yesterday (November 27). They have been made by the original builders of the aircraft, Sir W. G. Armstrong Whitworth Aircraft, Ltd., and before being handed over to Mr. Drew had been checked for accuracy by Mr. J. Lloyd, chief designer when the Siskin and Atlas were produced and now a director of the company. The presentation was being made on behalf of A.W.A. by A. Cdre. W. Wynter-Morgan, the company's services liaison officer (aircraft). The models are eventually to be displayed in the National Aviation Museum which is to be opened in Ottawa next year.

The Siskin was the first aircraft built by A.W.A. and was the first all-metal aircraft in the world to be adopted by the R.A.F. The Atlas was actually flown on operational sorties in Canada at the beginning of the Second World War, by Army co-operation squadrons patrolling the entrance to Halifax harbour.

SISKIN AND ATLAS models being discussed by A.W.A.'s managing director, Mr. H. M. Woodhams (left, with the Atlas) and A. Cdre. W. Wynter-Morgan, holding the Siskin (see above)

FLYING AT EASTLEIGH, home of Saunders-Roe's helicopter division, are seen the first two P.531 five-seat general-purpose helicopters, powered by Blackburn Turmo 600 Series free-turbine engines of 425 s.h.p.

NATO in Orbit?

PLANS are afoot to put a NATO satellite in orbit by 1960 for "peaceful outer space research." This was announced by Dr. Theodore von Kármán, chairman of AGARD, in Paris last Friday. He said that after a preliminary meeting in Paris the NATO scientists would move on to Washington. The proposed satellite would cost "only about £35,700" as the U.S. would contribute the rocket and launching equipment.

No NA.39 "Conflict"

IN a Parliamentary answer on November 19 the Minister of Defence, Mr. Duncan Sandys, said that there was no "inter-departmental conflict" about the future operational rôle of the Blackburn and General Aircraft NA.39. Answering Mr. Roy Mason (Barnsley), who had asked the Minister whether he were aware that there was "a lot of childish inter-Service rivalry about the aircraft" and if it were not time he stepped in to solve the conflict, Mr. Sandys said: "It is not a question of stepping in. We have to try to decide what we shall need in the mid-1960s and the second half of the 1960s. . . . I think it is better that we should take a little longer now rather than take a wrong decision and waste a great deal more time and money."

EP.9 Changes Hands

FUTURE production of the EP.9 should be assured by the purchase—announced last week—of Edgar Percival Aircraft, Ltd., by Samlesbury Engineering, Ltd., one of the Eric Rylands group of companies. The re-organized Percival company, of which Mr. Eric Rylands (head of the Eric Rylands group) is chairman, will have Sir Wavell Wakefield, M.P., and Mr. E. W. Percival also on the Board, Mr. Percival acting as a non-executive director.

Certain important changes have also been announced. The name of the company will be altered to Lancashire Aircraft Corporation, Ltd. (formerly a subsidiary of Eric Rylands, Ltd., then transferred to British Aviation Services, who have agreed to cede the title to Mr. Rylands). The EP.9 will be re-named, and production of it is eventually to be transferred from Stapleford to Samlesbury, near Blackburn, and Squire's Gate, Blackpool.

That R.34 Memorial

CONTROVERSY over the proposed R.34 memorial cropped up again last week, this time in the House of Lords. Initiating a debate on the subject, Lord Brabazon asked the Government if they would arrange for the model of the design to be placed in the library of the House; whether the Minister of Transport had sanctioned the erection of the memorial at London Airport; and whether the Government considered that a bronze memorial 14ft high from this design "would be a suitable object for exhibition at the principal gateway of Britain as an example for arrivals from the Commonwealth and foreign countries of British culture." He said that the basis of the objection to the memorial was not on whether it was a work of art but whether it was suitable.

In his reply to the debate the Earl of Home, Secretary of State for Commonwealth Relations, said that the Minister of Transport and Civil Aviation was not in an easy position. A private body had commissioned the work, the Royal Fine Art Commission had approved it, and in the normal course the Minister would give his consent. But he would undertake to speak to the Minister about the debate, and ask him to consider the matter in company with the Air League. He could not say the Minister would be willing to revise his decision.

Naval Aircraft Restrictions

ALL Scimitars, Sea Vixens and Hunter T.8s in Fleet Air Arm service were grounded temporarily at the beginning of this week. An Admiralty spokesman gave as the reason that the operation of the ejector seats was suspect. The grounding followed an accident on November 19 when a Scimitar pilot, S/Lt. C. R. Cresswell, died from his injuries after ejecting at low level near Invergordon.

Another restriction on Naval aircraft this week was that Whirlwind 7s should operate only over land. Recent Whirlwind accidents have occurred over the sea (in one case with the loss of a pilot) and it is hoped that in the event of a recurrence the "land only" restriction will help to provide evidence of the cause.

IN BRIEF

H.M.S. *Girdle Ness*, the R.N. guided weapons trials ship (referred to and illustrated in the *Flight* article on Seaslug last week), was due to berth at Devonport Dockyard last Wednesday, November 26, after completing her programme in the Mediterranean.

* * *

Piloted by S/L. H. W. Thwaites, R.A.A.F., with F/O. Alan Green as navigator, a Short/English Electric Canberra U.10 left Belfast last Monday for R.A.F. station Benson on the first stage of its delivery flight to the Woomera rocket range. The U.10 is a pilotless-drone conversion of the B.2.

* * *

The Canadian Aeronautical Institute has been invited to participate in the seventh joint Anglo-American Aeronautical Conference organized by the Royal Aeronautical Society and the Institute of the Aeronautical Sciences. This meeting will be held in New York during October 5-16, 1959, and the programme may include a one-day visit to Canada.

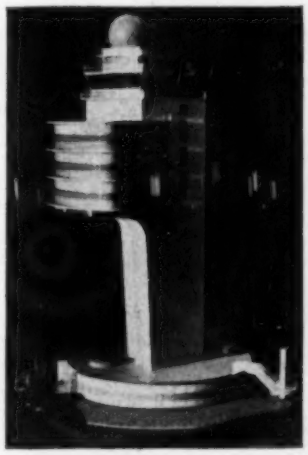
* * *

At the December meeting of the London Society of Air-Britain (Caxton Hall, Westminster, December 3, 7 p.m.) Mr. C. H. Gibbs-Smith is to speak on *The Cody Controversy*, and *The Royal Observer Corps Master Test Film 1958* is to be shown. Visitors are welcome.

* * *

Now available (at 6s, postage 8d) is *'The Autocar' Road Tests—Autumn 1958*, containing test reports on 21 British and foreign cars. Also on sale is (5s, postage 7d) *'The Motor Cycle' Road Tests, 1958-59*, covering 23 British motor cycles. Both are published by Iliffe & Sons, Ltd., Dorset House, London, S.E.1.

SIR JOHN HUNT congratulates members of the Air Training Corps after they had received the Duke of Edinburgh's Gold Award from the Duke at Buckingham Palace on November 18



MODEL CONTROL: The new 150ft-high control tower at Newark, N.J., cantilevered on top of a concrete shaft, will be erected in the dead centre of the airport. It will cost $750,000 and should be in service by next autumn

Examiners at Home

ACTIVITIES OF THE R.A.F. HOME COMMAND EXAMINING UNIT

ONE of the consequences of the recently announced abolition of R.A.F. Home Command is that its Examining Unit, based at White Waltham, will be disbanded in January 1959. The following article, based on a visit made to the unit before the Air Minister's announcement about Home Command, describes the full scope of its work and pays tribute to its achievements during just over ten years' busy existence.

A WOODEN hut of wartime pattern, on the edge of White Waltham airfield, contains the administrative offices of the R.A.F. Home Command Examining Unit. Within walking distance are housed six of the unit's seven aircraft—two Mosquito T.3s (the only ones of their kind still in R.A.F. service in this country), two Anson 19s, a Balliol and a Chipmunk. The seventh, a Vampire T.11, is kept at R.A.F. Odiham.

The unit shares this joint-user airfield with the Fairey Aviation and M.L. Aviation Companies, the Home Command communications squadron, and the West London Aero and Fairey Flying Clubs; but these grassy undulations in the eastern corner of Berkshire (not even White Waltham's best friends would describe it as a billiards-table) provide merely a base for H.C.E.U. activities —which range from Aberdeen in the north to Southampton in the south, and from Belfast in the west to Cambridge in the east.

The fact that these cities all possess universities is no coincidence, for the unit's work is primarily concerned with keeping up flying and instructional standards at the 17 university air squadrons. In addition it similarly checks standards at the Chipmunk Flight at the R.A.F. Technical College, Henlow; makes a regular springtime visit to instructors at the 29 flying clubs under contract to Air Ministry for the A.T.C./C.C.F. flying scholarship scheme; appoints instrument rating examiners on squadrons and gives I.R. tests to staff officers; and checks out pilots for the Nos. 61 and 64 Group communication squadrons and those NATO-style-named bodies the CAACUS and CFCCUS (civilian anti-aircraft/fighter control co-operation units).

The Home Command Examining Unit started life in 1947, at R.A.F. Honiley, as the Instrument Training Flight of Reserve Command. Then in 1949 it moved to White Waltham, becoming a flight of the Reserve Command communication squadron. Two years later it achieved its present separate identity. In ten years' existence the "trappers" (as the university squadrons term the unit's members, with a mixture of affection and apprehension) have built up a reputation for thoroughness and fair-mindedness and done much to ensure high standards of pilotage on the squadrons and units with which they have to deal. The unit's work is thus complementary to that of the Central Flying School at Little Rissington, Glos.

Staff at the H.C.E.U. consists of the C.O. (S/L. J. E. W. Teager, A.F.C.) and six flight lieutenants (C. M. P. Kempster, deputy C.O.; E. Connell, the adjutant; R. A. Locatelli, D.F.C. and Bar; C. R. White; A. J. Couchman and D. J. Curtis). All have master green instrument ratings except one, who has a green; and four are A.1 instructors, the others being A.2s. Average total flying time of each member of the staff is about 3,500 hr. All have other duties besides their flying and the only other personnel on the unit are a typist and a man who does odd jobs and (most usefully) makes tea. There are no airmen on the strength, servicing of H.C.E.U. aircraft being done by the Fairey Aviation Co. This is no mean task in the case of the Mosquitos, on account of their comparative age and the difficulty of obtaining spares and replacements.

When the full scope of the unit's work is realized, it will be seen that the seven officers have a very busy time indeed. Most of it is spent away from base and in addition to flying they spend many hours writing reports and setting and marking examination papers. As already indicated, the unit's primary task is to check flying and ground instructional standards at the university squadrons. This involves regular visits to the widely situated U.A.S. headquarters and also to the squadrons when they are in summer camp at R.A.F. stations. Both instructors and students are given checks, and if an instructor does not come up to standard at his first test he is asked to come to White Waltham after a few weeks for a further one. Thus, should he temporarily have allowed his standards to lapse, he is given ample opportunity of proving himself. H.C.E.U. pilots also fly with U.A.S. cadets (as squadron representatives) for the annual Hack Trophy competition, written tests for this being set

S/L. J. E. W. Teager, O.C. the Home Command Examining Unit, gives his staff a little "refresher" briefing on the G4F compass. With him, from left to right, are (standing) F/L.s A. J. Couchman, E. Connell and R. A. Locatelli; (seated) F/L.s D. J. Curtis, C. R. White and C. M. P. Kempster

A Mosquito study likely to rouse nostalgic memories of wartime intruder operations, but taken in peaceful conditions recently over Bedfordshire, with F/L.s Curtis and Connell of the H.C.E.U. flying the unit's two T.3s

"Flight" photograph

The two Mosquito T.3s operated by the H.C.E.U. with (in the left foreground) the wing-tip of the unit's Balliol, flown by F/L. White, from which this study was taken by "Flight" photographer Ian Macdonald

"Flight" photograph

F/L. A. J. Couchman (right) tests a Glasgow U.A.S. member's knowledge of external checks on a Chipmunk during the squadron's summer camp this year at R.A.F. Thorney Island

"Flight" photograph

and marked by the unit. Further, each squadron is issued with a comprehensive set of questions for the Preliminary Flying Badge examination. These are similarly prepared by the H.C.E.U. and the marked papers are subsequently scrutinized at the unit's headquarters.

Brief reference has already been made to the Examining Unit's contact with flying clubs which operate the A.T.C./C.C.F. flying scholarship scheme. About 90 civilian instructors are involved, and the unit holds a watching brief on behalf of the A.O.C-in-C. Home Command (Air Marshal Sir Douglas Macfadyen), who has the responsibility of seeing that Air Ministry gets its money's worth for the five guineas an hour paid for the 30 hr course given to cadets. So in this aspect of its work, as in all others, the Examining Unit aims to see that high standards are maintained.

There is a slightly different angle, however, to its connection with the civilian anti-aircraft and fighter control co-operation units; for here the prime task is that of converting pilots who are generally quite experienced (and perhaps hoping to go in for airline flying) to Meteors, Vampires, Mosquito TT.35s or Balliols. In addition, all pilots at these civilian co-operation units are checked annually by the Home Command examiners. The CAACUs are at Woodvale (where there is also a met. flight) and Exeter, and the CFCCUs at Ouston, near Newcastle-on-Tyne, and Perth. At the CAACUs the number of pilots varies from 16 to 20, and there are about three at each of the CFCCUs.

As if all this work (with the country-wide air travel it involves) were not quite enough to keep the H.C.E.U busy, the unit also provides staff officers with limited facilities for brushing-up their instrument flying and gives all new university squadron Q.F.I.s a short Chipmunk course before they take up their U.A.S. appointments.

Last year the unit's members did a total of 2,089 hr flying; but the number of hours airborne gives only a one-sided indication of how much time its varied duties involve. Many more hours are spent in setting and marking papers and compiling reports.

In the final analysis however, the contribution made by the Home Command Examining Unit to R.A.F. and civilian flying standards is something that cannot really be measured by statistics. It is brought about not only by hard and conscientious work and the combined skill and experience of the unit's members, but also by their tact and understanding in dealing with pilots who vary so widely—from university cadets who have only just started flying to senior staff officers and civilians with several thousand hours' experience.

H. W.

H.C.E.U. aircraft lined up at White Waltham. From left to right, two Mosquito T.3s; two Anson 19s; a Balliol; a Vampire T.11; and a Chipmunk

"Flight" photograph

Bright paint schemes, tinted canopy, radio, spatted undercarriage, heater, a cruising speed of 120 m.p.h. and many other refinements characterize the Normande Jodel D.117 for which Rollason, the British agents, have now obtained a British C. of A. Further details are given below

Normande Jodel Approved by A.R.B.: Luton Major Up-to-date: Agricultural Aircraft by Phœnix

MORE FOR THE LIGHT-AIRCRAFT BUYER

THE choice of club and touring aircraft types available to British pilots is noticeably widening, largely by virtue of the importation or licence-construction of foreign types. Special aircraft for agricultural flying are also on the increase, and three new machines in these categories are described below.

Normande Jodel D.117. The French Certificate of Airworthiness for this machine and its radio has now been validated by the A.R.B. following inspection of the demonstrator, registered G-APOZ. The British agents are Rollason Aircraft and Engines, Ltd., Croydon Airport, Surrey, who sent the machine to the successful rally at Little Snoring a fortnight ago. It is factory-built by Société Aéronautique Normande, accommodates two people side-by-side, is powered by a Continental C.90 engine and has a heater, 12-channel Radiostal V.H.F. radio and ample luggage space. Cruising speed is 120 m.p.h. and spoilers mounted beneath each wing should afford excellent short-landing characteristics. Rollasons are now able to offer delivery of D.117s in a matter of weeks at a price of £2,500 duty paid, ex-works, with radio and 12 months' C. of A.

Phoenix Luton L.A.5 Major. Phoenix Aircraft, Ltd., of Cranleigh Common, Cranleigh, Surrey, are now offering an improved version of the pre-war Luton Major tandem two-seat, high-wing monoplane. Price of a complete aircraft is £1,598. The plans alone cost £20, a figure which includes membership of the Popular Flying Association. The makers can supply advice on home construction and the P.F.A. would carry out the necessary supervisory work for the granting of a permit-to-fly. The Major has a speed range of between 35 and 105 m.p.h. and can be fitted with any engine of between 60 and 90 h.p. The wings may be folded for storage in confined spaces. Cost of home construction is estimated by the makers at between £500 and £600.

Phoenix P.A.L.7 Spray-Master. In response to a specification issued by Agricultural Aviation, Ltd., Phoenix are designing an agricultural aircraft of mixed construction, to be powered by a de Havilland Gipsy Major 10 or equivalent Lycoming or Continental engines. The fuselage will be of welded steel tubes and the agricultural payload is to be 1,000 lb. Spray gear like that already fitted to the Chipmunk Mk 23 is to be manufactured for the P.A.L.7 by Agavco. Some details of the work of this company were given in *Flight* for October 24 (the new agricultural machine there mentioned was, of course, the P.A.L.7 and not the Luton Major).

AIR ELECTRONICS STANDARDIZATION

AT an inaugural meeting of the Air Transport Electronics Council—held on November 18—Sir Victor Tait, K.B.E., C.B., B.Sc., was appointed chairman. With the aim of standardizing civil aircraft radio equipment and systems installations and to promote the development of systems for future air operating requirements, the council has been formed from representatives of the Electronic Engineering Association (representing British radio and electronics manufacturers), the S.B.A.C., B.O.A.C., B.E.A. and the B.I.A.T.A. Mr. J. S. Simpson has been appointed secretary and offices have been established at 37 Park Street, London, W.1 (Hyde Park 5024).

BLACKBURN ELECTRONICS

A NEW venture—that of designing and manufacturing electronic equipment commercially—has been started by Blackburn and General Aircraft, Ltd., and a new organization with its own design and development departments and production and sales organizations has been formed at Brough under Dr. Harry Fuchs.

Dr. Fuchs, who is 28 and joined Blackburn in 1956, was responsible for the company's analogue computer and for the servo-mechanism of the high-speed wind tunnel which Admiral of the Fleet Earl Mountbatten opened at Brough earlier this year.

LIGHT-AIRCRAFT AUTOPILOTS

A "VERY substantial" order has been placed by Cessna with Tactair, Inc., for autopilots intended as optional extras for the 175, 180, 182 and Skylane. Piper have already announced that *de luxe* versions of their aircraft will have an electric flight-control system. The Tactair units are operated entirely from the aircraft vacuum system, using vacuum bellows as actuators and specially modified artificial horizon and direction indicator as references.

Hitherto the standard Tactair unit has been the T-3, which offers three-axis stabilization, longitudinal and lateral manœuvring and heading-lock and change. Cessna are adopting two simplified versions of this system: the T-1, which is simply the aileron channel controlled by a modified artificial horizon; and the T-2, which includes the heading control using the modified direction indicator.

Both T-1 and T-2 are called Levelair. They can be brought up to full T-3 standard or kits can be supplied for installation in the field. The T-3 units weigh some 12 lb. Since the system is entirely pneumatic, there is no warm-up time and it can be overridden manually without damaging the actuators. The cost of the T-1 and T-2 is respectively $795 and $1,095 (about £285 and £395).

BRIGHT OUTLOOK FOR ORPHEUS

NEWS that Lockheed Aircraft Corporation is to put the Jetstar into production has been warmly welcomed by Bristol Aero-Engines, Ltd., whose Orpheus turbojets power the two prototypes now flying. Production models of the Jetstar will be offered either with two Orpheus units or four General Electric J85s.

The Orpheus has been largely sponsored by the U.S. Government for NATO programmes, and Bristol also stand to benefit from West Germany's recent decision to buy 200 Orpheus-powered Fiat G-91s. Fifty of these are to be made in Italy and the remainder in Germany, where it is expected the engines will be made under manufacturing rights held by the Federal Government. It has been reported that licence fees for the German-built Orpheus would total £400,000 sterling.

OVERSEAS PUBLICITY

REPRESENTATIVES of the S.B.A.C. and leading British aircraft and aero-engine companies visited the new headquarters of the Central Office of Information (off Westminster Bridge Road, London) on November 18 to see how the raw material of all publicity media is collected and processed for use at information posts throughout the world. These overseas posts, they were told, distribute hundreds of copies of British aviation journals, and these are used to augment official publicity campaigns.

In his welcome to the visitors Mr. E. C. R. Hadfield, Overseas Controller, spoke of the "close and effective" co-operation which had always existed between the C.O.I. and the S.B.A.C. and said he hoped that it would be strengthened and extended in the future.

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GW.16

KINALOG

A NEW APPROACH TO BLIND-FLYING INSTRUMENTATION

FOR many years the standard method of presenting attitude information on an artificial horizon has been to display a fixed silhouette of an aircraft in relation to a horizon bar maintained substantially parallel to the visual horizon by a gyro. This method presupposes that the pilot's most natural vertical reference is that of the aircraft itself, as opposed to that of the earth, and it makes the pilot feel that he is looking at a horizon from inside the aircraft—an inside-to-outside view. Certain foreign instruments, employing the opposite method, have shown a moving aircraft silhouette against a fixed horizon-bar, thus presenting the picture as a pilot might see it if he were held upright somewhere behind the aircraft—an outside-to-inside view.

Both Hughes Aircraft and Lear in America have in recent years made detailed investigations of the relative psychological advantages of these two presentations and both have come to the conclusion that the outside-to-inside view is better. But since the change from one system to the other requires considerable adaptation on the part of the pilot, standardization has been substantially maintained in favour of the inside-to-outside presentation.

Further research by Convair, at San Diego, some time ago seemed to indicate that neither of these presentations was in fact entirely natural. Convair realized that a situation could arise in which the artificial horizon-indication seen by the pilot contrasted with what his other senses told him. A sharp mental conflict developed when he tried to resolve the difference between the information externally offered by the visual reference and the immediate physical sensations produced by his ears and other parts of his body, that is, his kinesthetic sensations. For his first twenty years or so a man maintains an upright posture by co-ordinating sight and sensation relative to a visual horizon and the gravitational pull of the earth. In the normal course of events these references generally remain constant, but in an aircraft the very important reference of a gravitational pull may be considerably distorted and often becomes downright misleading. After a series of pronounced manœuvres ending, perhaps, in a sustained steep turn or spiral dive, the g force acting through the body persuades the pilot that vertically up is where his head is pointing. During visual flight, his eyes immediately and unmistakably correct this impression, but during instrument flight the reference is less readily appreciated and far less willingly accepted. The sharp conflict between bodily sensation and visual reference may well result in confusion and disorientation—in vertigo—and the wrong corrective action has often proved fatal. Any pilot who has flown on instruments will have experienced vertigo to some degree. It tends to be much more severe in aircraft which can change attitude very rapidly and which can maintain high g-forces for long periods of time, but cockpit and instrument design can of themselves have a marked effect in inducing or dispelling the sensation.

The semi-circular canals behind the ear can be upset by snapping the head rapidly forward and back to the upright position over one shoulder. A cockpit control positioned to require such a movement when the pilot looks at it can seriously disturb him during instrument flight.

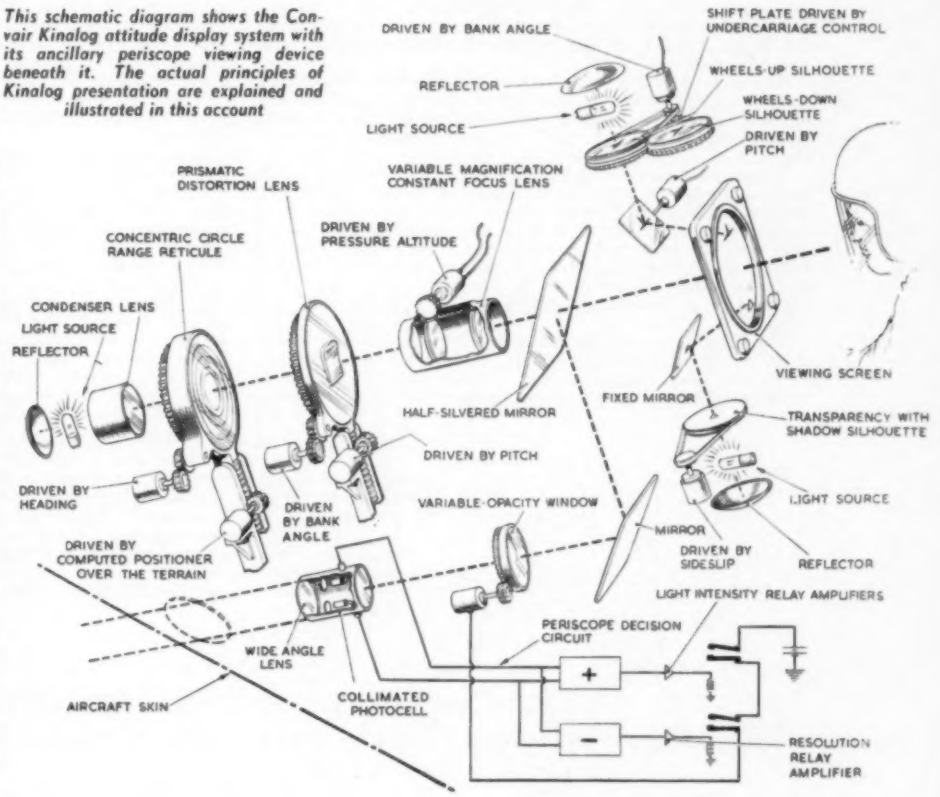
The Convair research programme therefore aimed at developing an instrument system which would completely eradicate vertigo. The presentation was to include all the necessary quantitative and qualitative blind-flying information and, particularly, was to be based on techniques and equipment which were already within present production capabilities. The work was carried out by Mr. Lawrence J. Fogel, head of the Convair reliability group, and trials have been made in a fixed-base simulator. But because both the U.S.A.F. and U.S. Navy were committed to new instrument systems already under active development, no funds were allocated for further work by Convair. The new system has been patented by Convair and could be produced either for military or civil application.

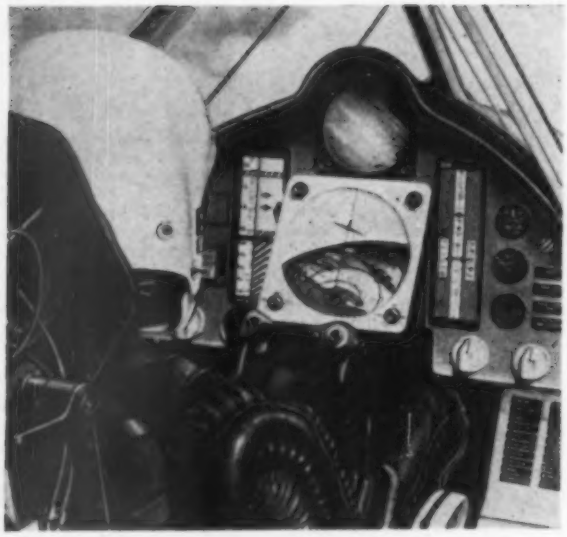
The solution which Mr. Fogel proposes is at once ingenious and novel, and warrants serious consideration. The designer has extensively studied the psychological factors involved in human control of machines and has done much work towards formulating these as a mathematical expression. He maintains that the inside-to-outside and outside-to-inside attitude presentations are not so much two distinct methods, but are the extremes of a connecting continuum. During straight and level flight both visual and physical sensations of the true vertical are in harmony so that the pilot instinctively knows "which way is up." When he banks the aircraft his senses visualize the movement as a rotation about the visual horizon, that is, in the inside-to-outside way. But if the turn is maintained the pilot's body adapts itself to the new attitude and allows the g sensations to persuade him that "up" lies relative to the aircraft and no longer relative to the horizon. He therefore naturally changes to the outside-to-inside viewpoint. The process of adaptation takes up to 30 sec, depending on the severity of the g forces produced in the turn.

The Convair solution employs a combination of the two presentations arranged, as the accompanying diagrams illustrate, so that initial banking of the aircraft is shown as a movement of the silhouette in relation to a stationary horizon. During the following 20 sec or so, if the turn is maintained, the silhouette gradually returns to the level attitude and the horizon rotates with it, maintaining accurate indication of bank angle, so that when the pilot is himself adjusted to the aircraft "up" as opposed to the true "up," the horizon presentation too has made the change (from inside-to-outside to outside-to-inside). Pitch displacements are similarly recorded so that, when the nose is pulled up, the silhouette moves up and then gradually both horizon and silhouette sink down till the silhouette is centred on the dial. This forms a kinesthetic analog, which Convair have dubbed Kinalog.

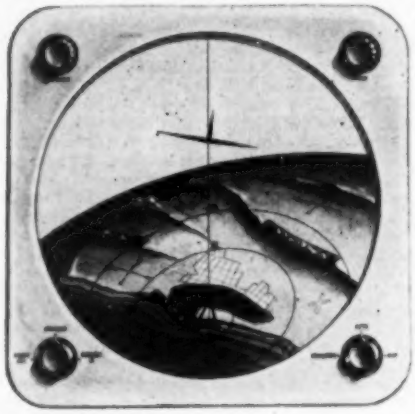
In addition, the attitude display has been designed to incorpor-

This schematic diagram shows the Convair Kinalog attitude display system with its ancillary periscope viewing device beneath it. The actual principles of Kinalog presentation are explained and illustrated in this account





(Left) Arrangement of Kinalog and tape instruments. (Below) How the Kinalog would show the aircraft settling into a climbing turn to the right. Aircraft-range rings and perspective map are appropriately orientated. The four control-knobs, clockwise from top right, are for focus; periscope/map/automatic selection of either; Kinalog, inside-out or outside-in display; and picture intensity



KINALOG . . .

ate a natural representation of height and plan-position. Mr. Fogel realized that the pilot spends most of his time in the air looking neither straight forwards nor vertically down, but downwards at an angle of about 20 deg. But he observes his attitude from the horizon and his ground position by looking straight downwards. A map display in the Kinalog instrument therefore shows an idealized map of the ground in sharp perspective so that the horizon appears to lie virtually at eye level while the nearer portion of the map is viewed vertically, the perspective being produced optically by a prismatic distortion lens. Thus attitude of the aircraft would be indicated by the aircraft silhouette in relation to the map horizon while ground position would be indicated by the location of a triangular symbol over the lower, vertically-viewed portion of the map. The symbol would be aligned to show side-slip angle relative to a centreline representing track. Aircraft-range rings would be superimposed on the map display to indicate the range capability of the aircraft in relation to height and remaining fuel.

Height is broadly indicated by increasing and decreasing the magnification of the map picture in such a way that at low altitudes the horizon appears practically straight while at high altitudes it becomes curved, giving the pilot an illusion of being further above the earth.

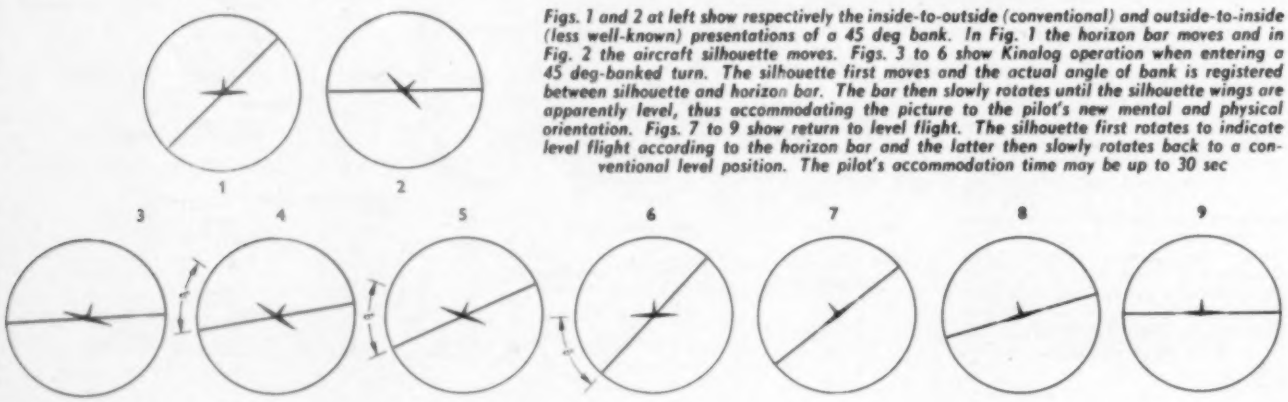
A large proportion of the topographical details normally visible to the pilot can be described as unwanted "noise" contributing nothing to judgment of either attitude or position. The Kinalog map picture would therefore be greatly simplified and marked only with important features and airfield information. Compass roses would also be superimposed at intervals to provide a heading reference. High ground might be shaded in various colours to indicate immediately the approximate height of hills and mountains.

The Kinalog would form the central dial of a complete instrument layout which would include vertical-tape indicators for height and speed quantities, a special clock display in the form of lights and relevant engine, fuel system and navigation instruments. The layout would be divided vertically so that quantities controlled by movement of the control column, that is those governed by the right hand, would be shown to the right of the Kinalog; and those concerned with power and fuel, controlled by the left hand, would lie to the left. Fire-control, search or bombing radarscope would take the commanding top centre position. The layout is illustrated at top left of this page.

The Kinalog display itself would be electro-mechanically generated by modifying an optical back-projection of a micro-filmed map and superimposing on it the triangular position symbol and the aircraft silhouette. The exploded view of the system on p. 823 shows how this would be done using components which can be produced with existing knowledge and techniques.

An additional feature is the possibility of adding to the synthetic display an actual visual image derived from a forward-looking periscope. The light-sensitive circuit shown in the drawing on p. 823 would control the variable-opacity window so that the natural view would be superimposed when external light conditions could provide a good picture. Yet another feature is that a second aircraft silhouette showing the undercarriage extended could be substituted for the "clean" one when the undercarriage had been lowered. This would provide immediate and unmistakable indication of undercarriage position on the primary attitude indicator.

The back-projection system of Kinalog uses a collimated light beam directed through a map transparency mounted together with a reticule bearing the concentric range circles. The assembly would be rotated by a heading signal and moved up and down according to position information computed, in the Convair system, from bearings derived from two V.O.R., Vortac or Tacan receivers tuned to different beacons. The perspective distortion showing a horizon and plan-position would be achieved by a shaped prismatic lens whose mounting was rotated by bank signals and moved up and down by pitch signals. The illusion of height would be achieved by a further lens which varied magnification while maintaining constant focus, the degree of magnification being controlled by a signal derived from pressure altitude. Further projectors above and below the display would superimpose the



Figs. 1 and 2 at left show respectively the inside-to-outside (conventional) and outside-to-inside (less well-known) presentations of a 45 deg bank. In Fig. 1 the horizon bar moves and in Fig. 2 the aircraft silhouette moves. Figs. 3 to 6 show Kinalog operation when entering a 45 deg-banked turn. The silhouette first moves and the actual angle of bank is registered between silhouette and horizon bar. The bar then slowly rotates until the silhouette wings are apparently level, thus accommodating the picture to the pilot's new mental and physical orientation. Figs. 7 to 9 show return to level flight. The silhouette first rotates to indicate level flight according to the horizon bar and the latter then slowly rotates back to a conventional level position. The pilot's accommodation time may be up to 30 sec

ROLLS-ROYCE DEVELOPMENTS

Thrust Reversers For Turbo Jets

Rolls-Royce have been developing thrust reversers for turbo jet engines since 1954, and are producing reversers for the Avon engines of the de Havilland Comet 4. Similar units are being tested for the Conway engines of the Boeing 707-420.

Units designed for the Avon have accumulated more than 1,600 hours running time, including 150 hours in the reverse thrust position, and over 4,500 reversal cycles have been completed on the test bed, in a specially modified Hawker Hunter and in the Comet 3.

A reverse thrust equal to 50% of the forward thrust of the engine is achieved with these units. The stopping power of this, on the Comet, is approximately equal to that of the aircraft brakes in favourable conditions. The performance loss arising from the thrust reverser is three-quarters of one per cent of engine thrust at take-off.

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D

In a recent case of Uncivil Law
Mr. Justice Bloop remarked

"Little Horses? Little Horses? WHAT ARE LITTLE HORSES?"

Whereupon the defendant, turning a bright purple and brushing aside a number of gold plated, diamond studded Counsel, whom he had retained and refreshed at fabulous fees, leapt to his feet and cried: "My Little Horses are the driving force of the motors that power the World's Finest Power Tools, Electric and Pneumatic. Some of them ¼ h.p., some ⅛ h.p., and some more or less and notwithstanding. *Big* Motors — *Big* Horsepower; *Little* Motors — *LITTLE* HORSEPOWER — DESOUTTER HORSEPOWER. All the world knows and loves my Little Horses . . ."

At this point loud N-e-i-g-h-i-n-g was heard from the public gallery, and His Lordship ordered the court to be cleared.

FASTEST—Type O3, High Speed Pneumatic Grinder—70,000 rpm.
SLOWEST—Type R39, Rotor Pneumatic Drill of 165 rpm. For drilling Titanium.
BIGGEST—Type H2, Electric Drill, ½" chuck.
TINIEST—Type M60, Reversing Miniature Pneumatic Screwdriver weighing 8 ozs.
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KINALOG . . .

aircraft attitude and position symbols on the screen in the manner shown in the drawing.

The generation of the Kinalog picture seems to require straightforward servo techniques using signals from conventional information sources such as a master gyro reference, compass system and air data computer. The position indication could be provided quite conveniently from the radio-aid computer or from a speed signal derived from aerodynamic or Doppler radar sources. The projection system is compact and simple and should therefore be effectively reliable. It should also be possible to arrange the lamps and map transparency to be easily changed in flight. The degree of attenuation when light is projected through the various lenses has not been stated.

In both height and speed displays, located beside the Kinalog, Mr. Fogel appears to have found an effective solution to some of the apparent disadvantages of tape indicator systems. There are two alternative methods of tape presentation, one using a moving pointer and the other a moving scale on tape. The first provides a natural picture of aircraft movement, but the necessarily limited length of the scale makes accuracy down to tens of feet very difficult to achieve. A moving tape, on the other hand, can be made in any length and can therefore provide any required accuracy, but its movement is in the unnatural sense since the tape moves down when the aircraft climbs up, and *vice versa*. At least a slight mental adjustment is required of the pilot. The "unnatural" movement of the very accurate moving-tape method can be overcome by printing the figures in rising values from top to bottom (reading downwards 7, 8, 9, 10 and so on), but the scale then requires, as Mr. Fogel puts it, "negative interpolation which is opposite to the population stereotype," i.e., people are used to counting from the bottom to the top of a column.

Mr. Fogel has devised a tape system which overcomes these disadvantages. His altimeter has a broad opaque tape containing a viewing window crossed by a horizontal reference line. This moves over a fixed scale and provides a coarse height indication. A further window in the opaque tape reveals a detailed scale of about 1,000ft printed on a second moving tape so that the appropriate correct value of hundreds and tens of feet, or even smaller values, is positioned opposite the reference line showing the coarse indication on the fixed scale. Correct scaling of the gear drives to this second tape can provide an apparently realistic movement of the tape, despite the fact that its actual movement is in fact in the "unnatural" sense.

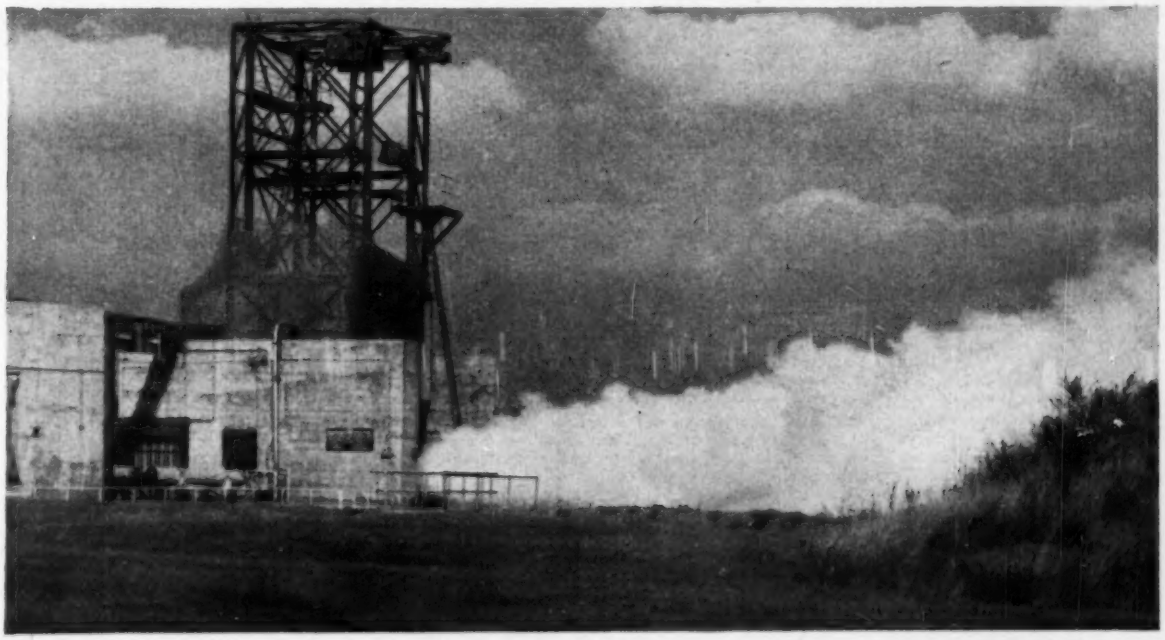
A third window in the left-hand side of the tape reveals a rate-of-climb and descent tape with the relevant value again positioned under the main reference line. The drive for this indication is a relatively simple differential gear system linked to that of the opaque tape. It can be seen that this system provides natural movement in combination with any degree of accuracy required from the indication. The central scale shows an immediate coarse height indication which can be quickly detailed by reference to the right-hand tape. Despite the great accuracy which can be achieved, the movement of the reference line over the scales is always apparently natural.

The speed presentation, showing both Mach number and indicated or true airspeed follows similar principles; and target and command values may simply be superimposed on the relevant scales. The combined display is arranged to give an entirely natural picture of aircraft behaviour and response. Rearward movement of the control column, for example, raises the nose and this is shown by the movement of the aircraft silhouette. It initiates a rate of climb which is recorded immediately to the right of the Kinalog. The same reference line moves over the coarse height scale and from a quick glance, gives an idea of the position of the aircraft in its operating height band. On closer inspection the height can be judged to the nearest 500ft. Reading all the height figures on both scales from left to right shows the exact height. All these values are controlled by the right hand on the control column and are indicated on that side of the cockpit. Speed, being largely a function of power, is shown on the left, together with engine indications.

Active work on Kinalog has now ceased, but more than a dozen test pilots "flew" the simulator which Convair originally made for it and in general they approved of the scheme. More exhaustive tests, particularly in actual flight, are required to prove the concept properly, but since no funds have been made available this is not at the moment contemplated. Extensive studies of human reactions and the suitability of the height display were also made by Convair. Information on all this work is available and it has been stated that, if a customer ordered Kinalog for a Convair 880, for example, it would be completed and installed. Short of that, the details of Kinalog are being made generally available. The attitude display itself appears well worth further study; and the tape display is noteworthy in view of the fact that a dial altimeter and V.S.I. have now been returned to the British tape and roller-blind panel.

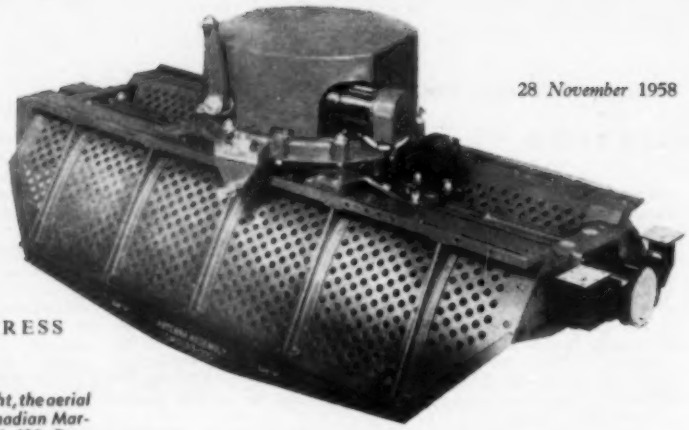
BLACK KNIGHT WEARS A WHITE PLUME

To accompany this picture—spectacular if not, perhaps, very revealing—Armstrong Siddeley Motors have disclosed a few telling facts and figures about the rocket motor which powers the R.A.E./Saunders-Roe Black Knight research vehicle (the first firing, at Woomera on September 7, was officially described as "an extraordinary success," an altitude "in excess of 150 miles" later being mentioned). A.S.M. say that the motor —the combustion chambers of which are pivoted as two pairs, as reported in a "Flight" article on the missile (October 17)—is named Gamma Mk 201 and has a sea-level thrust of 16,400 lb, rising to 19,000 lb outside the Earth's atmosphere. These figures, they add, could be substantially increased. The picture shows the Gamma on test at Ansty



Doppler Developments

MARCONI, BENDIX AND RYAN PROGRESS



Above right, the aerial of the Canadian Marconi CMA-621 Doppler radar, which has been evaluated by Pan American. It rotates to record drift angle and is pivoted for pitch compensation. At left is the indicator unit of the C.D.C. Skyline Doppler computer. The lower counter shows miles along track and the upper counters miles across track

SEVERAL new developments have recently taken place in the field of Doppler radar. For example, a Marconi AD.2000 system, as used by the R.A.F., has been installed in a DC-3 by Hunting Aerosurveys in Canada for use in photographic-survey flying. The AD.2000 is mounted under a streamlined radome beneath the forward fuselage, its presentation being photographed by an F.24 camera to provide positional information for recording the operation of a Wild RC.5A vertical survey camera. A Canadian Applied Research, Ltd., Airborne Profile Recorder Mk 5 radar altimeter, mounted under the rear fuselage, is also monitored by a 35mm camera; it measures and records terrain clearance. Aircraft flight level is recorded by a hypsometer, or barometric-height deviation indicator. An Eagle IX camera, mounted at an angle in the extreme nose, records the azimuth of the survey photography. This is the first civilian AD.2000 installation for other than demonstration and test purposes.

Now beginning to set the pace in the commercial Doppler market is the Canadian Marconi CMA-621 which was recently tested in a DC-7 by Pan American on scheduled flights over many kinds of terrain. Despite frequent flights over calm sea and over smooth, undulating desert, CMA-621 is reported to have maintained accurate operation to within 1 per cent of groundspeed and drift for 98 per cent of its operating time. Serviceability and ease of maintenance by the operator have been particularly impressive and PanAm are reported to have been able to work to overhaul periods identical with those of simpler airborne electronic equipment. They also endorsed the advantages of navigation aids maintained by the operator and independent of ground installations.

An evaluation model of the new Bendix Doppler for civil airliners is to be delivered by the end of the year. It is an FM/CW system with a fixed, four-beam aerial array transmitting beams 3.5 deg wide. Received signals are electronically compensated for changes in aircraft attitude up to a pitch limit of 10 deg, and for roll limits depending upon height and terrain. Transmitter power is 0.5W, groundspeed range from 100 to 1,000 kt and maximum drift angle ±40 deg. The basic system weighs 60 lb, not including cabling, transmission lines or mounting bases, and a duplicated system would weigh 103 lb. Rack-mounted units consist of the transmitter/receiver and frequency tracker. A needle-and-counter instrument shows drift and groundspeed respectively.

The computer for Bendix DRA-12 is called Skyline (a transistorized unit of that name is produced by Computing Devices of Canada, Ltd.). It accepts gyro-compass and Doppler information and produces course- and offset distance-error signals for an autopilot and the usual distance-gone, distance-to-go and track-angle information. Three-digit and two-digit counters are provided for, respectively, along-track and across-track indications.

Ryan Aeronautical Company, long active in Doppler development, have now received orders from both U.S. Navy and Army which require them to double their facilities by the end of this year. The first order, worth $20m, is from the U.S. Navy for AN/APN-122 (V) Dopplers to equip Neptunes, Marlins, Skywarriors and three Grumman types, presumably the Tracker, Trader and Tracer. It is a CW system and can be combined with several navigation computers already in naval service, such as the Ford Instrument Company's AN/ASN-7. The AN/APN-97 is already in production as a special Doppler allowing automatic hovering in the Sikorsky HSS-1N. It was described, with the related control system, in *Flight* for October 10.

In October 1956 Ryan produced the Model 103 Doppler for the U.S. Army and followed this in February this year with the Model 108. An initial order for about $1m has now been placed by the U.S. Army Signal Supply Agency for the RANAV Model 120A which has been tested in a Beaver at Fort Huachuca. It is believed to operate in the region of 13,000 Mc/s and is a CW system. Of particular interest is the fact that the two beams transmitted either ahead of or behind the aircraft emanate from and are received in a single aerial dish divided by a septum and using space-duplexing in a single transmitter/receiver. Doppler signals are detected by a direct-to-audio system, eliminating the need for I.F. amplifiers, local oscillators and automatic frequency-control. The radome is made as part of the equipment and the transmitter/receiver contains no moving parts. Aerial and transmitter/receiver are combined in a single unit. A signal-data converter provides analogue outputs proportional to the Doppler frequencies.

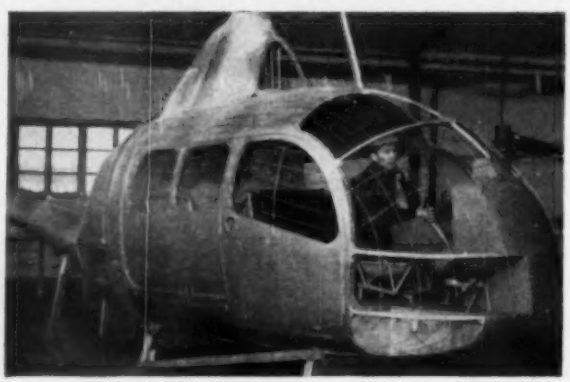
For helicopter applications, a small additional aerial is provided to allow transmission of four beams so that both vertical and horizontal movement can be detected.

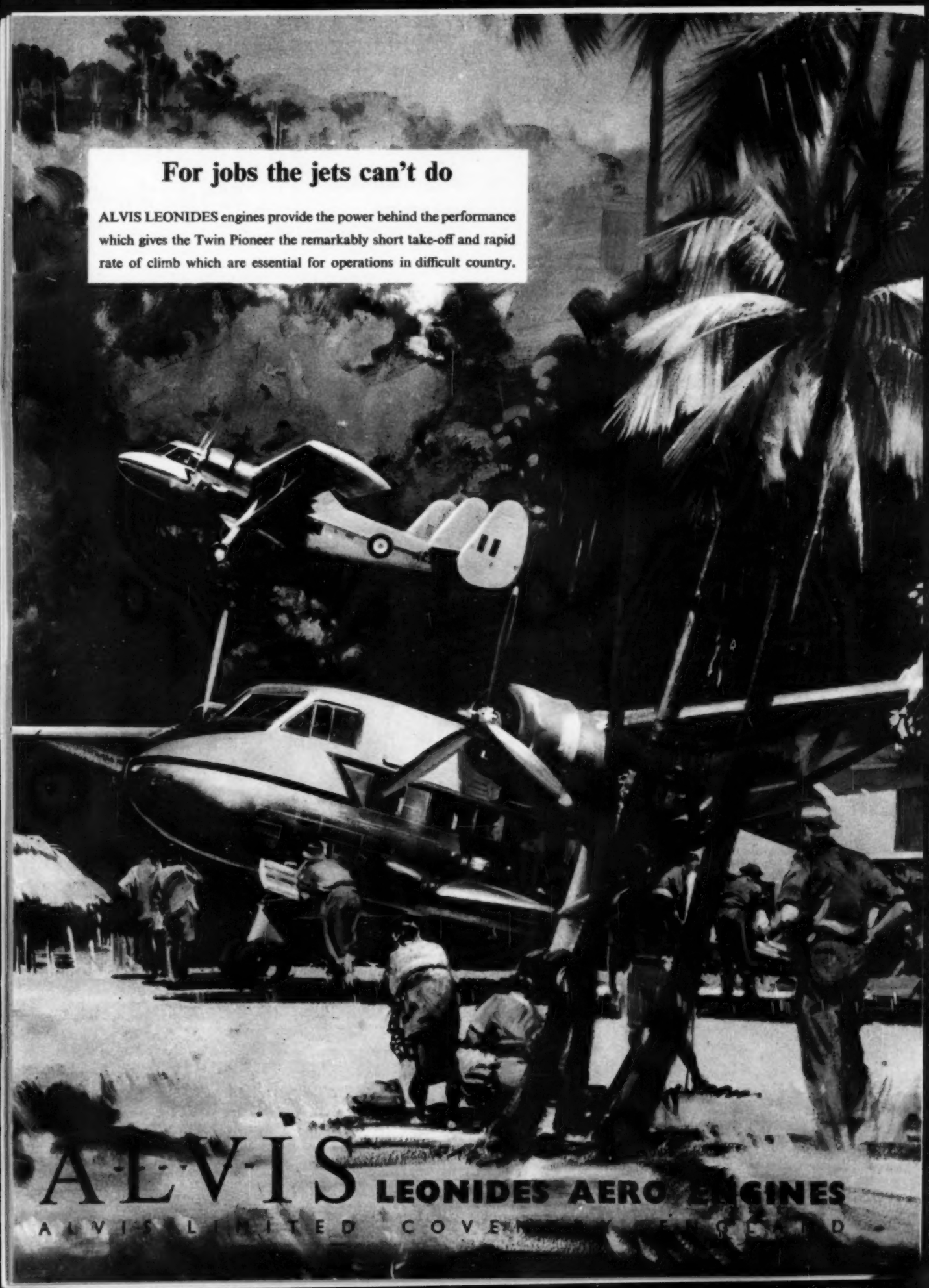
Doppler signals are corrected for aircraft attitude and vertical speed and passed to the navigation computer/indicator. Windspeed and direction are calculated and can be used for the memory function after loss of signals. Drift and groundspeed and course and distance to either a destination or base are calculated. A flight instrument connected with the system displays pitch and roll angles, heading and rate of turn. Finally, there is a dead-reckoning position indicator on which a "bug" in the form of a lighted arrow shows the position and heading of the aircraft relative to a grid or map display. Such an accessory is particularly useful for low-level flying in areas where special and changing information must be provided. Since the main system computes according to magnetic north, the difference between this and the grid north are fed to the computer and any type of grid or map may be used.

It seems probable that RANAV Model 120A will see wide service in both fixed- and rotating-winged U.S. Army aircraft.

CZECHOSLOVAKIA'S LATEST

Seen in the photograph below is a mock-up of the new HC-3 helicopter designed by the Czechoslovak Aeronautical Research Institute. It is to be a general-purpose machine with very full navigation aids. No power-plant details are yet available

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Aeronautical Bookshelf

Airship, Aeroplane, Aircraft: Studies in the History of Terms for Aircraft in English, by Svante Stubelius. Almqvist and Wiksell, P.O. Box 96, Stockholm. Swedish Kr. 25.

IT is only natural that there should be a tendency for all of us to cherish two delusions: that we know our mother tongue; and that when we communicate with another Englishman he will understand the words we use in the sense that we ourselves attach to them. It is rather shattering, therefore, to find that the Gothenburg Studies in English, of which this is the seventh volume, can devote a lengthy and interesting treatise to the analysis of the hundred-and-one different senses in which various authorities have used common English words. (One previous volume is solely concerned with the word "do," and another volume is entirely devoted to one use of "should.")

Readers of *Flight*, however, will be more interested in quotations from earlier issues of this journal in which the use and definition of terms for aircraft have been hotly discussed. For example, there have been arguments that an "aeroplane" is only an aerofoil, not the complete aircraft, whilst others objected that an aerofoil cannot be an aero*plane* because it is not two-dimensional. As late as December 1953 no less an authority than Sir William Farren wrote, "It might be a good way to commemorate this occasion [the 50th anniversary of the first flight of the Wright brothers] if we decently buried 'aeroplane' and 'airplane' and in future proudly flew our flags on 'airships'."

The following quotation from 1910 sounds today as though it were meant to be funny: "A big blustering fellow stood on the back end of a street car recently and spent a quarter of an hour explaining to a party of his friends the difference between an aeroplane and a monoplane, and when he had finished his friends agreed that he knew all about airships."

Lest anyone should imagine that the need for unambiguous definitions is now safely past, he has only to turn to our non-technical national Press and see the misuse of words, even by the so-called technical correspondents who describe any motor car or ship with a gas turbine as "jet-propelled." W. J. G.

Men and Machines (a history of D. Napier and Son), by Charles Wilson and William Reader. George Weidenfeld and Nicolson, Ltd., 7 Cork Street, London, W.1. Price 35s. Illustrated.

VERY few commercial concerns can boast a record of a century-and-a-half in precision engineering. D. Napier and Son are celebrating their 150th anniversary this year, and to mark the occasion they have published a history that is superior to most works of this sort. (Company histories often give such undue consideration to personalities and internal susceptibilities that they make dull reading for anyone outside the firm.)

While engineers may perhaps complain of lack of technical detail here and there, and possibly challenge some of the claims, *Men and Machines* is distinctly readable and contains a wealth of information about early motor car building and aero engine production during a great period in industrial development.

Neither men nor machines are infallible, whatever the inspiring genius or trademark. Essentially a family concern in origin and development—it was built up by only three generations of the same family—Napiers sometimes lacked the broad concept and thinking that so often mark a highly personalized business. They learned that it was possible to pursue an apparently fruitful line of development in aero engines which would end in a blind alley, and the decision to put all the company's eggs into one "air basket" obviously affected its fortunes.

But Napiers are known, and rightly so, for their successes and for the excellence of their products from the early golden years of the motor car to the turboprop and rocket engines of today. Ironically enough, it was in 1942, when the business had never been so large and prosperity apparently more assured, that the firm reached the end of its independent life and became part of English Electric—which was conspicuously fitted to supply some particular deficiencies.

Montague Stanley Napier, grandson of the founder, designed his first motor-car engine in 1899, a two-cylinder vertical model of about 8 h.p. mounted in a Panhard body. It was the beginning of an association with Henry Francis Edge, who was manager of the London branch of the Rubber Tyre Company. Together the two young men fired each other with a desire to advance the cause of automobilism and awakened the country to the possibilities of the enormous new industry.

By 1918, with the impetus given to aero-engine business during the war, Napier, whose mission had once been automobiles, made the hard decision to abandon cars altogether. In collaboration with A. J. Rowledge, he developed the famous Lion 12-cylinder, three-row engine, fitted in some 35 aircraft types in the early twenties.

Napiers took a leading part in the rearmament drive of the thirties, finally coming up with the liquid-cooled Sabre (1938) which powered the Hawker Typhoon and Tempest fighters.

Although some of their post-war engine developments were not financially rewarding, Napiers scored again with their medium-power Eland turboprop, with the Gazelle helicopter engine; and they have also chalked up successes in the development of rocket motors for missiles (e.g., the NRE.17) and for manned aircraft (the Double Scorpion for the Canberra).

Today the company run half-a-dozen production and research centres in and around London. Whatever the future may hold, the skill and know-how built up over such a long period is bound to stand them in good stead, for aviation, despite its rapid growth, still has its roots buried deep in the past. A. J. W.

Camera in the Sky, by Charles A. Sims, A.I.B.P. Temple Press, Ltd., Bowling Green Lane, London, E.C.1. Price 25s. Illustrated.

THIS is a book the author obviously enjoyed writing, and for those readers who have grown up with the aircraft industry it will vividly recall many notable happenings and aircraft of the past. To those who have come in recently—with the jets, guided missiles and practically no private flying—it will tell of an aeronautical way of life of which hitherto they have had no cognizance.

The author has solved the problem of presenting in an easily studied form his photographs and reminiscences (gathered since he joined No. 84 Squadron at Shaibah in 1923) by classifying them under such headings as "Air Exercises," "Naval Occasions," "Royal Occasions." If the arrangement seems slightly disjointed in effect, it should be remembered that chronological order would have entailed continued and lengthy explanations in pages where every square inch is valuable. The subject-matter really deserves more generous space; it is apparent that there has been difficulty in cramming the pictures and incidents into such small compass.

As Air Chief Marshal Sir James Robb observes in his foreword, the aircraft industry has been well served photographically. This is very true of Charles Sims's camera work. In this book is reproduced the cream of his pictures—of personalities, events, places and air-to-air shots of aircraft—of all of which (though the reproduction does not always do him justice) he can be justly proud. J. Y.

They Flew the Atlantic, by Robert de la Croix. Frederick Muller, Ltd., 110 Fleet Street, London, E.C.4. Price 18s. Illustrated.

NOT since the earliest air conquests of the North Atlantic has the ocean crossing been so much in the news as now, with the recent triumph of the Comet. Stirring though this is, the fact remains that it is but one episode in a story of evolution, a milestone in the transition from piston-engine to turbojet. Britain, after all, scored a previous Atlantic first: for the record, the first non-stop aerial crossing was made by two Englishmen, Alcock and Brown, in a converted Vickers Vimy bomber. It was a long, long time ago—even before Juan Trippe and Boeing.

They Flew the Atlantic underlines two things, if nothing more: the air crossing between America and Europe was an uncertain operation even before the doubts raised by decibels; its final conquest was the joint work of aviators of many nations.

This book tells the story of those pioneers—Walter Wellman, Charles A. Lindbergh, Nungesser and Coli, Levine and Chamberlin, Ruth Elder and the others. One reads of these early flights, successful and otherwise, and marvels again at the vision and enterprise—but without getting quite the atmosphere or sense of real drama. The aviation achievement comes through without the impact of human emotion or purpose. The fact that this otherwise competent work fails on this score may in part be due to the difficulties of translation from the French. A. J. W.

OTHER BOOKS RECEIVED

Gas Turbines for Aircraft, by Arthur W. Judge. Chapman and Hall, Ltd., 37 Essex Street, London, W.C.2. Price 60s.

Handbook of the Aircraft Industry, edited by J. L. Nayler and T. F. Saunders. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 35s.

Electricity In Aircraft, by F. G. Spreadbury. Constable and Co., Ltd., 10-12 Orange Street, London, W.C.2. Price 40s.

Space Flight, by Dr. Carsbie C. Adams. McGraw-Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4. Price 50s 6d.

Flight into Danger, by John Castle and Arthur Hailey. Souvenir Press, Ltd., 94 Charlotte Street, London, W.1. Price 11s 6d.

Nuclear Rocket Propulsion, by R. W. Bussard and R. D. DeLauer. McGraw-Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4. Price 77s 6d.

The Sinking of the Bismarck, by Will Berthold. Longmans, Green and Co., Ltd., 6 & 7 Clifford Street, London, W.1. Price 16s.

And There Was Light, by Rudolf Thiel. Andre Deutsch, Ltd., 12-14 Carlisle Street, Soho Square, London, W.1. Price 25s.

Flying Witness, by Graham Wallace. Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1. Price 25s.

The Air Forces of the World, by William Green and John Fricker. Macdonald and Co. (Publishers), Ltd., 16 Maddox Street, London, W.1. Price 60s.

The Proving Flight, by David Beaty. Penguin Books, Harmondsworth, Middlesex. Price 2s 6d.

Aircraft Control by Computer

BASIC PROBLEMS AND POSSIBLE SOLUTIONS

By F. H. GEORGE, M.A., Ph.D.*

IT is sometimes suggested that the general-purpose digital computer would be a possible means of aircraft control, to replace pilots, navigators and engineers; but the problem is by no means simple—even if it were at the moment worthwhile—and it raises many interesting engineering problems.

The general-purpose computer has an input system that translates the statical representation of binary numbers and instructions. This representation is in the form of punched cards and tape, and simply uses the hole and no-hole in any square as representing 1 and 0. In the machine itself it is a matter of pulse or no-pulse. Then there are various ways of storing the "words" that make up the binary language used by digital computers. The stores used are either fast, small and expensive or slower, larger and cheaper.

Before discussing the actual, or possible, manners in which digital control could be used, it would be well to elaborate on the principles of programming computers. The general-purpose machine is programmed by giving it a sequence of instructions on which it operates to produce a particular end-product in the form of the results of an arithmetical computation. We will illustrate the form of these instructions by reference to the Ferranti Pegasus computer.

A register is a simple storage unit capable of containing a computer "word." If we wish to clear a register, for example, and add into it the number in a particular accumulator (which is simply a specified register), then we use the order which has code 10. Then an instruction which transfers the number in accumulator 1 into register 1.2, for example, would read 1.2/1/10. Similarly, to clear a register and subtract from it the number in an accumulator, we should have an instruction like 1.3/2/12 where the register is number 1.3 and the accumulator is number 2.

A programme is simply a set of instructions like the above put into a definite sequence, where two orders may be contained in any one computer word, and where the word in the case of the Pegasus is made up of 39 binary digits. This is represented statically on tape and translated by the input into the pulses which circulate in the machine.

The Computer's Versatility

Rather than pursue detailed mathematical examples (which may tend to obscure the main issue) we shall talk now in terms of analogy, and will in such terms describe briefly the range of computer possibilities. When programming a computer one is giving it detailed instructions upon which it will operate and which it will follow methodically at very high speed. We can think of the machine as a literal-minded helper who can carry out any simple order involving addition of numbers (for example) but who can only carry out more complex orders if he is shown how to do it *in terms of such simple steps.*

In normal use, such a computer does only what it is told to do. Although it is best known and most used for solving mathematical problems, it can be utilized for producing other than purely mathematical conclusions.

It can also be used to direct mechanical or physical operations; here the prototype is in the computer-controlled machine tool, such as those produced by Ferranti and E.M.I. Such a system is essentially the same as in the conventional use of the computer as a mathematician. A particular shape is specified in terms of cartesian co-ordinates, and the precise co-ordinates relative to some origin are coded into the machine, together with some information about the rate of cutting and size of cutter. This way the exact curve is specified, and the use of servo-control of the piece to be cut ensures, by a feed-back system, that there is no divergence between the shape desired and the shape actually cut.

The next step is to advance from such straightforward and literal (deductive) programmes. We can use what have been called inductive, or learning, programmes. It is possible to demonstrate, with a simple game like noughts and crosses, the ability of a computer to learn simple tactical rules. Experience of failure and success is stored in the computer's memory until it "knows" the correct programme for the task in hand. The computer is capable of following explicit generalizations, of learning generalizations for itself, and, as well as providing answers to verbal or mathematical problems, of controlling mechanical systems.

In controlling an aircraft a certain set of operations must be performed in a specified order. In particular, the positions of various controls must be altered according to information fed in by the cockpit instruments, by radio or by looking outside. The first question to be settled is the nature of the necessary control, since this affects the type of computer equipment needed—especially the size of storage system needed.

If we are to allow the control system to learn we will need a vast storage capacity. Indeed we might ask whether there is any occasion in the course of a flight when a pilot needs to learn something new. Clearly, for the vast bulk of operations he does not; he simply makes direct responses to well-considered situations.

If we assume that we shall generally not use a learning programme then the whole process is much easier, but we should note the possibility of an auxiliary learning system that might mirror "experience" in a pilot, and which refers to small adjustments in well-understood tactics.

This means that we can build into storage the bulk of the ready-made generalizations that normally have to be taught to a pilot over a period of time. Moreover, it is possible that, with the development of input-feeding and output-reading at a distance, we shall be able to feed information to and from a large ground computer collecting evidence from a whole variety of aircraft under one control.

At the level of the powerplant and auxiliary systems—such as flaps and undercarriage—servo-systems will be needed to ensure that the prescribed position of each device shall actually be achieved. In this respect the essential problems are engineering ones, and demand the same basic treatment as in the computer-controlled machine tool. The state of research at the moment is such that a great deal of effort must be put into the choice of servos, with respect to their reliability, durability, weight and especially their size.

At the level of the control these same problems arise. Size is the most important factor, and the techniques of miniaturization are likely to be used extensively. This implies the use of even smaller two-state switches than those now available. It also implies error-controls and other safeguards that have been worked out at the level of theory and to some extent in practice.

New Conceptions of Control

Two important features stand out in the development of computer control of physical systems. The first is the fact that mechanical engineering and control engineering have developed independently. This in turn suggests that a rethinking of many of the mechanical systems in aircraft could take place. The second important point is in a sense a corollary of the first. Conventional aeroplanes are built around the human as the control system. This leads to considerable compromise in the instrumentation, owing to the need for presenting information in terms that appeal to the human senses. It is clear that a pointer reading only gives partial information about a system; for example, the complete hydraulic system only has its pressure indicated at one or two points; but the system is much more complex than this. In our computer-controlled system, we shall find that different measures can easily be used, information about the system being fed directly into the computer.

Again the analogy with the computer-controlled tool is a good one. The degree of error in comparing the actual state with the desired state is the best guide. All this implies the need for new engineering techniques, employing miniaturized principles.

The essence of the whole programme is theoretically straightforward. There is no doubt about the feasibility of the idea of a computer-controlled aircraft. What is debatable is whether or not piloting can be conducted on a fixed basis, requiring no—or the minimum of—immediate learning. This is almost certainly the case, even though we may expect to have fairly complex functional relations occurring (so that some variable may be a function of many independent variables, some of which themselves will be functions of other independent variables).

The next general point is that the actual computer control, and the possibility of more accurate and sure navigation and traffic control, suggest a new approach in reducing the gulf between an aeroplane and its ground control—and even its maintenance and organization. This raises a whole gamut of new ideas that could, and probably will, change the whole organization of flying.

Our last word is simply over the worth-whileness of the undertaking. It is a *sine qua non* that, at the moment, human pilots are reasonably cheap, compared with the computers, engineering equipment and research that would otherwise be required. Computer-controlled aircraft are inevitable because eventually the balance of costs will change in favour of the computer. Of greater importance is the fact that the whole of the construction, operation and maintenance of aircraft will be part of an integrated system, under an extensive computer control where the programmes will certainly be learning ones.

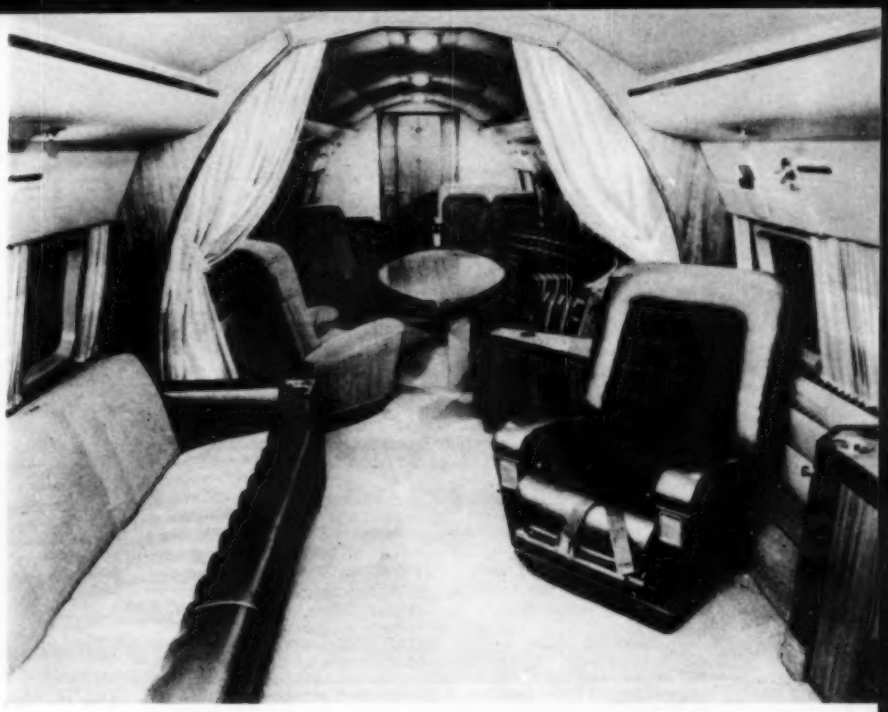
* *Department of Psychology, University of Bristol.*

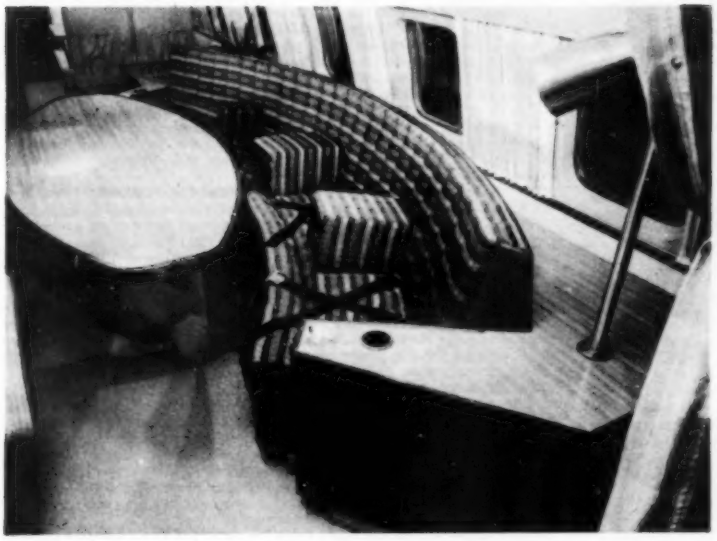
AYER-LINER

THE luxurious appointments of some of the larger American executive aircraft, illustrated in our "Business and Touring" issue of October 10, evoked exclamations of incredulity and envy from "B. and T." operators in this country. Here now is the latest and mostest—the "Ayer-Liner," offered by Frederick B. Ayer and Associates, Inc., of New York.

As seen from the exterior view at the foot of this page, the aircraft is essentially a Convair 240, thirty of these having been acquired by the company from American Airlines, for resale or lease either in the executive configuration or as conventional 40-passenger airliners. The executive Ayer-Liner is offered for $385,000.

On the right is a general view of the cabin. There are two couches and a set of seats, the latter convertible into beds. A galley is provided for the serving of hot meals, and fittings include a "ship-to-shore" telephone and AM-FM radio with magnetic tape recorder.





The second picture is a close-up which is captioned by Ayer in the following terms: "The drop-leaf conference table, which is edged in walnut, has a stain-proof top made of frosted walnut Formica. Mounted on two carpet-covered metal tubes that are fastened to the main floor beams of the plane, the table is vibrationless. It is set between an attractively designed crescent divan with removable arm rests and two reclining swivel chairs. The carpeting covering the entire floor of the cabin section is made of thick loop piled broadloom and is installed over a ½in thick foam rubber pad."

The warming scene at lower left inspires the company to write: "A convivial ride home with mission accomplished is just one of the many pleasures the Executive Ayer-Liner will bring to its new owner. The cabinet-bar is made of walnut with a stain-proof frosted walnut formica lid. Complete with two fully equipped utensil drawers, the unit also boasts a unique Plexiglas bottle-glass separating panel as well as a formica encased ice bucket."

IN THE BEGINNING

Points from Mr. Gibbs-Smith's Lecture to the Royal Society

THREE papers comprise the current series of Cantor Lectures being given in London before the Royal Society of Arts; each deals with a more or less specific period in the history of powered flight. The first of the three—*The Birth of the Aeroplane*— was delivered last Monday, November 24, by C. H. Gibbs-Smith, M.A., F.M.A., and is summarized below; the second, *The Development of the Aeroplane*, by Peter W. Brooks, B.Sc. (Eng.), A.C.G.I., A.F.R.Ae.S., is due to be given on December 1; and the series is to be completed on December 8 by Eric Mensforth, C.B.E., M.A., M.I.Mech.E., F.R.Ae.S., with *The Future of the Aeroplane*.

Mr. Gibbs-Smith approached his subject from a new angle, taking as a *motif* the independent lines of endeavour of two groups of pioneers and then the "long sleep" of the Old World experimenters during the period of the Wright brothers' successes in America. In the abstracts which follow we deliberately omit the author's detailed description of the American pioneers' work and concentrate instead on some less familiar history, a wealth of which he provided in pursuance of his theme.

The century that stretched from Sir George Cayley to the Wrights [said Mr. Gibbs-Smith] produced three main streams of endeavour, which had to meet and coalesce before man could successfully climb the skies in a mechanical flying machine . . . the science of aerodynamics; the craft of piloting and controlling a glider in the air; and the achievement of a light but powerful motor. Cayley laid the foundations of aerodynamics; he built successful models to demonstrate his theories; and finally, either in 1852 or 1853, he built a man-carrying glider: this machine, however, flew with its controls locked, and its human cargo was borne not as a pilot but as a passenger. Then, through the talent of such men as Henson, Wenham and Phillips in Britain, and Pénaud and Marey in France, the shapes of efficient aerofoils slowly emerged, along the pattern of the basic stabilities in flight . . .

Meanwhile, the tradition of aeroplane pilotage in the air had started tentatively with the courageous French sea-captain Le Bris between 1856 and 1868; but despite the further efforts to glide by Mouillard, Montgomery and others, no proper companionship was struck up between the would-be airmen and the successful model-making engineers, and piloted glider flight was not yet to be accomplished.

But the problem of the engine was being steadily and successfully tackled. In 1860 Lenoir had invented the gas engine: then Otto introduced the four-stroke engine in 1876; and by 1890 petroleum engines were effectively driving automobiles along the roads of Europe.

It was the decade of the 1890s which produced, all of a sudden, the first purposeful gathering together of research and endeavour, and the first successful piloted gliding flights. There also emerged during these ten years the vital and radically different concepts of what, for convenience, we may call the "groundsmen" and the "airmen" in aviation.

The groundsmen, deriving their attitude of mind from the model-makers of the previous generation, looked upon the aeroplane chiefly as a lifeless machine to be designed, constructed, and then made to work: the inventors regarded themselves as living outside the aircraft they created. As engines became more efficient, they set to building full-sized aeroplanes on the same principles as the model-makers—especially aiming at inherent stability—which the groundsman pilot would then drive . . .

Theory and Practice

Typical of the groundsman school of thought in the 1890s were Sir Hiram Maxim, who tested his huge but unproductive machine in 1894: Clément Ader, who just rose from the ground under power in 1890 in his *Eole*, but never left the ground when in 1897 he tested his *Avion III*; and Samuel Pierpont Langley, who—after his tandem-wing models had flown successfully in the 1890s—saw his full-size man-carrying *Aerodrome* fail twice in 1903. The first two men used steam engines on their power units; and Langley, after driving his earlier models by steam, employed the petrol engine in his last model (1901) and in his full-size attempts. It was the groundsman's attitude which, as will be seen later, retarded European aviation for so long . . .

The "airman" school of experimenters, although just as concerned with theory and research as their rivals, saw themselves as essentially partakers in the enterprise of flying. They were, by and large, more humble men, and therefore superior men for this job . . .

Typical of this attitude, following long after Cayley and Le Bris, were Lilienthal in Germany, Pilcher in Britain, Ferber in France, and Chanute (by proxy) and the Wright brothers in America . . .

It was the German Otto Lilienthal who was the first true aviator of history. He brought to a close the period of earthbound doubts and fumbling, and opened the way to the final solution of heavier-than-air flight. He conducted his remarkable experiments after a careful—but not, as it turned out, a very reliable—study of bird flight. He then built a number of monoplane and biplane gliders, which he flew successfully from 1891 to 1896, when he crashed and was killed . . .

Lilienthal's work was widely published in word and picture, and latter chiefly by means of the newly invented half-tone illustration process; and with his dramatic death he precipitated almost single-handed the ultimate phase of experiments which resulted in the achievement of the powered aeroplane. Lilienthal was the direct inspirer of Percy Pilcher, Captain Ferber, and—most important of all—of Octave Chanute and the Wright brothers.

Perhaps the greatest single tragedy in aviation history was the death of Percy Pilcher in 1899, after one of his gliders broke up in the air. Pilcher, like the Wrights who followed him, possessed all the necessary qualifications, technical, experimental and emotional, which could have led him to construct a successful powered aeroplane. At the time of his death he was building a motor to install in his last successful glider.

After Pilcher's death, British aviation provided one of the deepest mysteries of aeronautical history by going soundly to sleep for nearly a decade: its snores could not even be penetrated by the brilliant theoretical work on aerodynamics by F. W. Lanchester . . .

Despite the practical example of Langley, who did much to make the ridiculous idea of a flying machine respectable to his contemporaries, it was Octave Chanute who proved more influential in furthering the success of practical powered aviation. One of America's most distinguished civil engineers, Chanute was first infected with an interest in powered flight by meeting Wenham in England in 1875. He then made the first technical study of the history of heavier-than-air flying, and published his classic work *Progress in Flying Machines*, first as a series of articles, then in book form in 1894. A true airman at heart, his interest was re-energized, as it were, by the example of Lilienthal; and in the 1890s he designed and constructed a number of man-carrying gliders, which—as Chanute was now in his seventies—were piloted by A. M. Herring. Chanute's definite glider was his sophisticated Lilienthal-type biplane of 1896, with fixed main planes and fixed cruciform tail-unit. Chanute did not, as is sometimes supposed, introduce movable control surfaces. Control was solely by the Lilienthal method of body movement . . .

After the Wrights

Here the author describes the Wrights' work, from their No. 1 glider in 1900 to their epoch-making powered flight of December 17, 1903. He goes on to record their amazing progress in 1904 and 1905, which culminated in a flight of 38 min 3 sec on October 5, 1905. Then:—

The Wrights' last flight in 1905 was on October 16. Beset by snoopers, spies, and exasperating rebuffs by their own and other governments, the brothers decided not to fly again until they had succeeded in getting a fair business deal from some individual or organization willing to back their invention, which until now they had financed entirely out of their own earnings.

Thus there came about the second extraordinary feature of the Wrights' career; that they did not once take to the air between October 16, 1905, and May 6, 1908. They did, however, build new engines and a new aircraft in secret.

We now return to Europe. With the death of Lilienthal in 1896, and of Percy Pilcher in 1899, the zest and enterprise went out of European aviation; in the midst of one of the world's most flourishing periods of science, technology and commercial activity, the idea of heavier-than-air flying was almost abandoned. . . . Then, in the spring of 1903, Chanute came over to France and lectured on his own and the Wrights' gliding, extolling the latter as the most advanced form of flying yet achieved. He provoked a patriotic but bewildered reaction among a group of Frenchmen, who vociferously asserted that the land of Montgolfier must never allow the New World to win the race to powered flying. Unfortunately, none of the compatriots of Sir George Cayley were similarly awakened from their profound slumbers.

The French reaction to Chanute's news about the Wrights resulted in an astonishing—almost an absurd—course of events, and one of vital importance in aviation history. . . . By the summer of 1903 the Europeans were made aware by descriptions and photographs of more than the general configuration of the Wright gliders; surprisingly enough, it shows that Chanute described not only the Wrights' wing-warping, but their use of a rear rudder. But the old gentleman did not know, and therefore could not describe, how the two controls operated; nor that they were linked and used simultaneously. . . .

However, with the extensive work on aerodynamics and models over the past two generations as a technical background, the Europeans were now in possession of all the clues necessary for the achievement of a practical powered aeroplane . . .

But . . . some mass neurosis seems to have overtaken them. Despite the presence of able engineers among them, not a single man—let alone a team—got down calmly to the problems involved . . . And so, for five tedious years, the Europeans blundered gropingly . . .

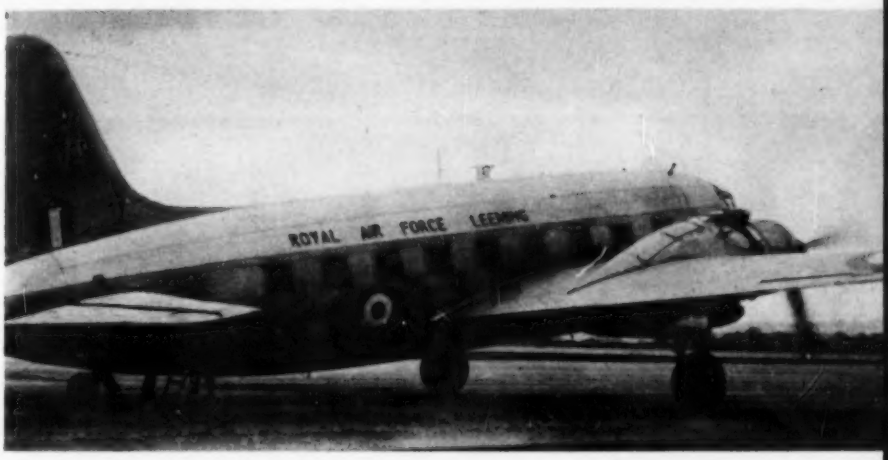
It was not until November 1907 that any European aeroplane could stay in the air for a single minute; it was May of 1908 before that time could be raised to a quarter of an hour; and June of 1909 before an hour's flight was made. Only one European aircraft had completed a circuit by January of 1908, and this basic manœuvre remained perilous for many months to come.

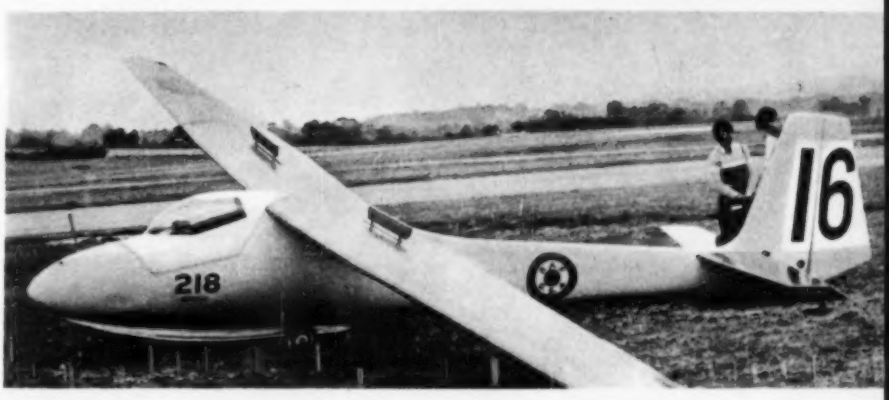
The final section of Mr. Gibbs-Smith's paper deals with Esnault-Pelterie, who unsuccessfully copied a Wright design (and, finding it would not fly, asserted that the Wrights' claims were false) but who was responsible for the first aileron; with Archdeacon, Voisin, Farman, Blériot and others; and the conclusion tells of Wilbur Wright's demonstration flights in Europe in the summer of 1908:—

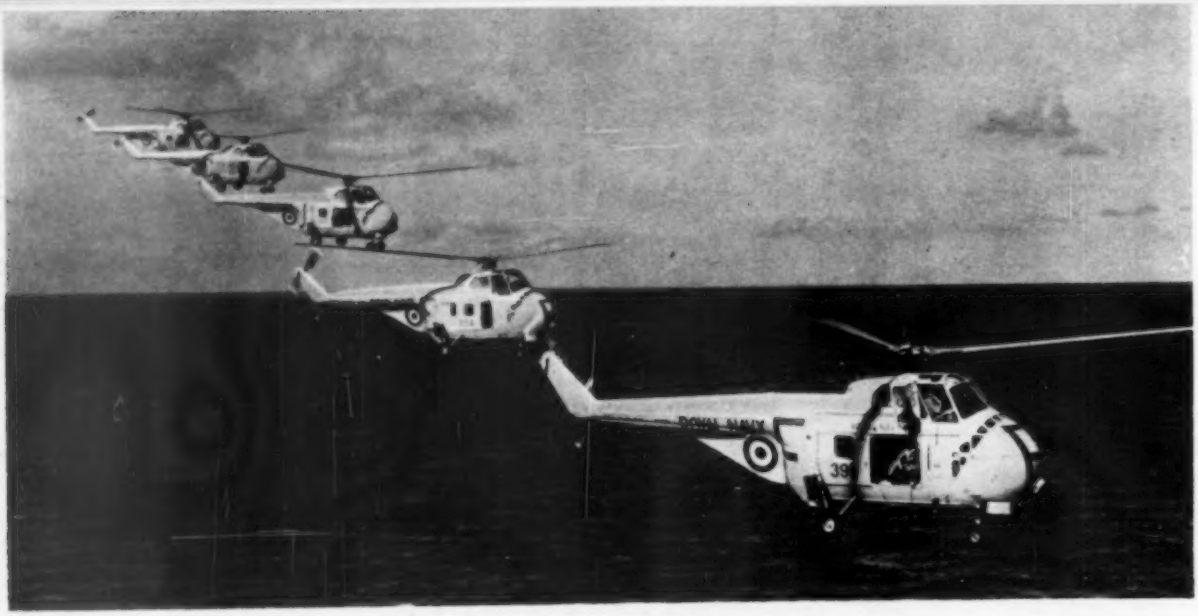
"Within days, the world of aviation realized that the secret had all along lain in manœuvrability; within weeks, it realized that this manœuvrability was a question of sensitive co-ordination of elevator, rudder, and wing-warping, and that it was greatly aided by the inherent instability of the aircraft and the consequent necessity for the pilot actively to control it for every second of its flight; and within months, that what was needed for the average pilot of the future was a combination of the stability beloved of the Europeans, and a good measure of sensitivity to the controls. . . . By mid-1909 every new aeroplane incorporated effective wing-warping or ailerons, and every pilot was realizing the true nature of flying. European aviation was thus re-born in 1909, and soon came to lead the world, finding at last all the talent and courage it had needed for so long."

MODES IN MARKINGS

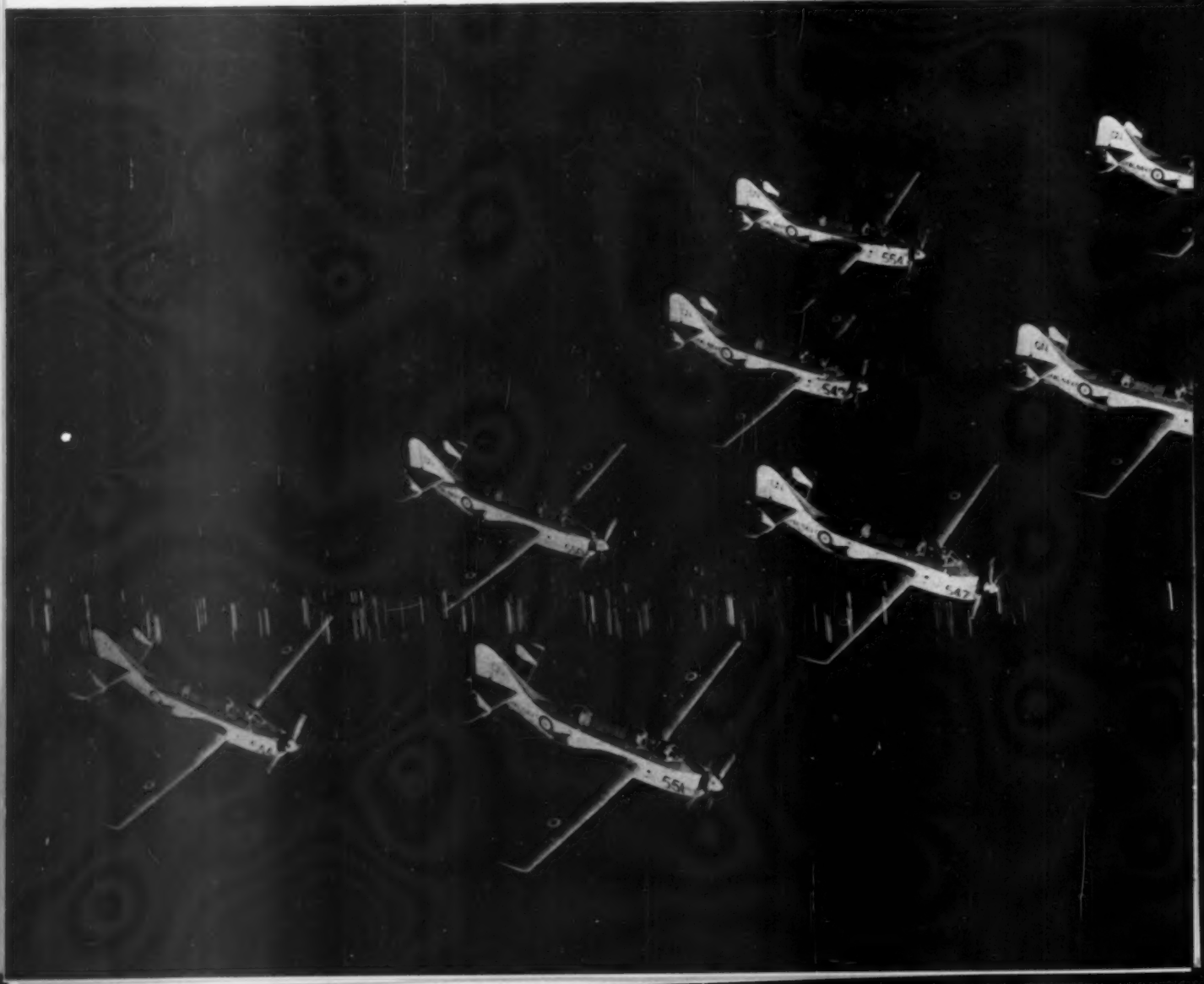
RECENT trends in the marking of aircraft are illustrated here. Above is an Auster AOP.7 of the Army Air Corps, with "Army" emblazoned large ahead of its serial number. The Valetta on the right exemplifies a new Transport Command system of station markings (in this instance Royal Air Force Leeming). The Slingsby Tandem Tutor below the Valetta belongs to the Royal Air Force Gliding and Soaring Association and bears the initials of the Association in the white ring of the roundel. Next comes a Kirby Cadet T.3 (Slingsby built) of 624 Gliding School, with an inscription that calls for no comment. Last is a Tu-104 bearing the new SSSR-plus-five-figure-numeral marking first noted this year. Markings of this sort have so far been seen on the Tu-104, -104A, Tu-114 and Super Aero 45. It is possible that this marking is applied to Soviet aeroplanes which are likely to travel outside the U.S.S.R., and deletion of the Cyrillic "L" previously carried by Aeroflot transports might make things easier for foreign airport staffs. There is some indication that these five-figure numbers are borne by new (not re-registered) aircraft.





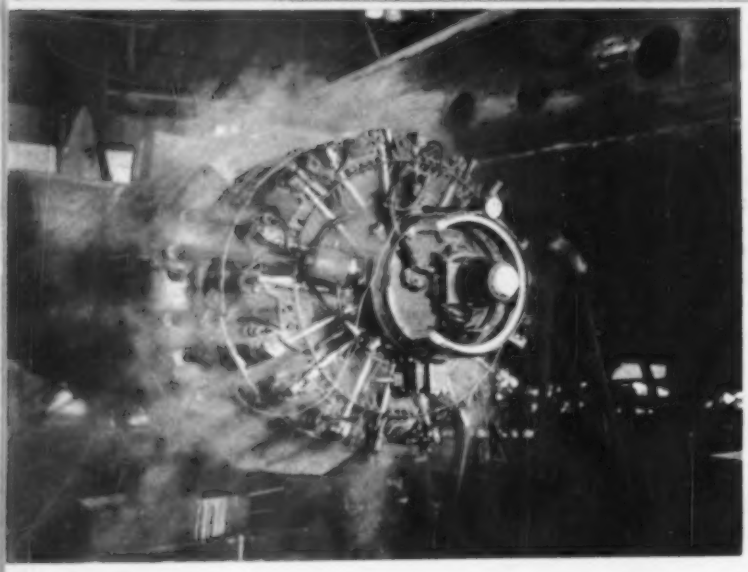


"FIND, FIX and STRIKE"



LIGHT
28 Nov.
1958
832-833

THE motto of the Fleet Air Arm, which this year celebrates the twenty-first anniversary of the resumption of its administrative control by the Admiralty, is epitomised by these pictures of some of its latest equipment. The Westland Whirlwind HAS.7 helicopter (Alvis Leonides Major engine), as seen at upper left, is the standard rotary-wing anti-submarine aircraft; and the Fairey Gannet AS.4, represented in the largest picture, is the standard fixed-wing machine in the same category. The Gannet has the Armstrong Siddeley Double Mamba turboprop. de Havilland's Sea Vixen FAW.1 (above) is the new all-weather fighter, in succession to the Sea Venom by the same makers. It has two Rolls-Royce Avon turbojets. As successor to the redoubtable Armstrong Whitworth/ Hawker Sea Hawk (Rolls-Royce Nene) comes the Vickers-Supermarine Scimitar F.1 (below), again with twin Avons and capable of functioning in the strike rôle. On order as the standard strike aircraft is Blackburn's NA.39 (two de Havilland Gyron Juniors). This aircraft was the subject of editorial comment last week.



Extinguishant being discharged over a Wright R-3350 engine through a spray ring located ahead of the cylinders. Some 6 lb of methyl bromide can be discharged in 1.4 sec in this way

Comprehensive Cover

GRAVINER CELEBRATE 25 YEARS OF FIRE-AND-CRASH PROTECTION

THIS month the Graviner Manufacturing Co., Ltd., is looking back on 25 years of pioneering in the development and production of fire-suppression and crash-protection devices for aircraft. It was in November 1933 that Mr. A. Mathisen, then a chartered patent agent, formed a company with the trade name Graviner (derived from "gravity" and "inertia") to produce the fire-suppression equipment which was soon to win an Air Ministry competition.

In those days relatively little was known about such equipment and it was not until World War 2 was well advanced that enough research and investigation had been carried out to allow a proper assessment of fire risks and suppression requirements for any particular installation. Mr. Mathisen and his company, together with R.A.E. and the Air Ministry Accident Investigation Branch, carried out the basic research and investigations from which the highly specialized knowledge and techniques were derived. What had begun as an ingenious idea developed into a store of know-how and experience which is almost certainly unrivalled anywhere in the world. Graviner was until recently the only company designing and producing complete protection systems for aircraft, but by a cross-licensing agreement, Fenwal, Inc., of Ashland, Mass., are now also able to offer similar service within North America.

It was quite an uphill task in those early pre-war days to convert people to the startling idea of using explosives in flame-detection and extinguishant-discharge systems, just as it appeared odd to use a highly inflammable fluid to quench fires. In one of the early demonstrations Mr. Mathisen actually set fire to his own car outside the Air Ministry and allowed the conflagration to be automatically detected and extinguished by his equipment. On another occasion a blazing Rolls-Royce car was driven into a wall to demonstrate the working of the inertia switch.

During 1937 the Wilkinson Sword Co. agreed to manufacture systems for Graviner and began a joint venture which is still in being today. When really large Air Ministry orders were placed during 1939 a second source of production was set up at Poyle Mill, Colnbrook, near what is now London Airport, and in the following year a further factory was started at the Fleetlands Foundry, Gosport. Graviner now produce 372 different items, 207 of which have Air Ministry reference numbers. The remainder are A.R.B. approved.

Graviner products can be broadly divided into six categories, namely, fire detection, fire extinguishing, crash protection, explosion protection, hand-held extinguishers and temperature control for industry. This last category is the result of the present policy of diversification. The Graviner industrial (as distinct from aircraft) explosion suppression system has allowed many companies to make use of lucrative processes which have until now been too dangerous to use because of explosion risks in such substances as sugar, coal and cork dust and wood flour. Graviner industrial suppression equipment has already saved valuable installations and prevented casualties on several occasions.

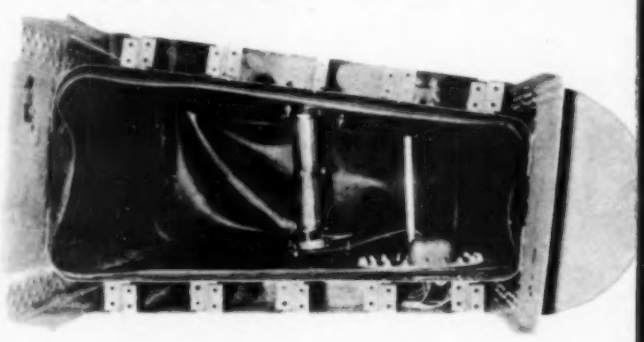
It was first discovered in 1944 by an R.A.E. team led by Mr. W. G. Glendinning (now Graviner's chief chemist) that the time interval between ignition of a fuel/air mixture and the development of the maximum explosive force could be used to dispense an inerting fluid to suppress the explosion. Shortly after an article on this subject appeared in *Flight* for December 28, 1951, the company received a Government contract to complete their private-venture work on the aircraft application. It was the first occasion on which such a contract was accepted by Graviner. Mr. Glendinning discovered that when an explosion occurs some 10 microseconds elapse before the pressure rise reaches about 4 lb/sq in, and it was found possible to produce a sufficiently fast sensing and discharge system to spread inerting fluid during this time. For certain aircraft, detection systems sensing the pressure rise proved too apt to be set off by normal disturbances from turbulence, fuel-sloshing, and other factors. A photo-electric sensing device using a photomultiplier tube mounted in the tank was therefore adopted. It proved sufficiently sensitive to "see" through dyed fuels and to detect the red or blue flames originated from "rich" or "weak" explosions. At the beginning of an explosion the detector activates an electronic relay to fire detonators inside steel canisters containing a mixture of suppressant and explosion-enriching fluids described as a "cocktail." The canisters are cylindrical and mounted to form a pillar across the tank space. They are machined with grooves which cause petalling and thus distribute the fluid evenly. They can be fired without damaging the tank—and the fuel remains usable after the system has functioned. The first complete equipment was delivered for use in an aircraft about three years ago.

Industrial installations generally have a pressure-sensing detector based on a double diaphragm with controlled leakage arranged to sense rate of rise of pressure or dangerous total pressure, discriminating against small ambient changes. The suppressant is contained in a hemispherical canister and discharged by a detonator. The system thus detects the pressure-front of an explosion flame and extinguishes it before the explosive force can develop to any large extent. Industrial systems have operated successfully on at least a dozen occasions. Though widely installed in military aircraft, the airborne systems have not yet been "fired in anger." They are considered superior to nitrogen purging because the oxygen released from the fuel during a rapid climb to great height may be sufficient to overcome the inerting power of the nitrogen and render the system useless during the climb. The nitrogen storage bottles are also quite heavy and require frequent recharging.

Traditional pyrotechnic flame-detection devices are still fitted in the older types of aircraft and are now widely used in railway diesel locomotives, but they have been largely superseded by the unit-resetting fire detector and the well-known Graviner Firewire. The unit-resetting fire detector uses differential thermal expansion to close electrical contacts and operate a warning circuit. It can be set to operate at any temperature from 20 deg C to 450 deg C. The tiny Gravinette temperature switch works on the same principle but covers temperatures from −70 deg C to 450 deg C and is widely applied in industrial temperature-control systems.

Firewire is probably the best known Graviner heat-sensing element, and it is installed in a large number of British and foreign military and civil aircraft. It consists of a stainless-steel capillary housing a coaxial electrode set in a filling material whose resist-

Cross-section of fuel tank with Graviner explosion-suppression equipment. The column is made up of suppressant canisters, and the photo-electric sensing unit is on the right



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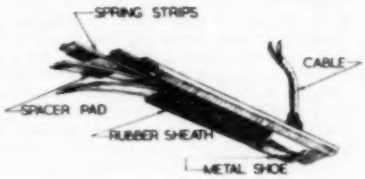
COMPREHENSIVE COVER . . .

ance changes with temperature to operate relays in a control unit. Either normal A.C. supplies or a D.C. current operating a transistor oscillator and switching system can be employed. In the latter case electro-magnetic relays are replaced by transistors. Firewire has the great advantage that it can be laid as a continuous element throughout a fire zone, providing complete coverage of a complex area with a single senser. It will provide indication of fire or overheat but reset itself as soon as temperature returns to normal. All Rolls-Royce Dart installations incorporate Firewire.

By on-the-spot investigation and close co-operation with accident investigation authorities, Graviner have been able to build up a remarkable practical knowledge of fire- and crash-protection. Mr. Mathisen and his assistants were frequently on the scene of accidents during the war and many of their recommendations have become accepted as standard practice. Some years ago A. Cdre. Sir Vernon Brown joined the company in an advisory capacity after 15 years' service as Chief Inspector of Accidents at Air Ministry, and Mr. N. G. Bennett, now chief engineer and a director, was for many years a member of the same branch. G/C. R. H. Horniman is in charge of the sales organization.

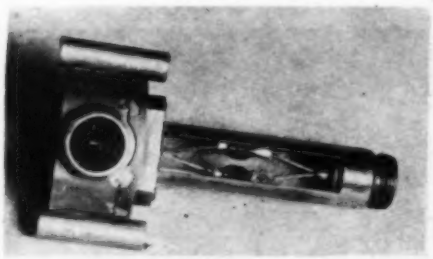
It has been generally accepted that a fire-detection device should simply operate a warning light in the cockpit and not initiate extinguishers automatically, because it was discovered at an early stage that extinguishing fluid released in strong wind blast had little or no effect. The fluid was dispersed before it could have its desired effect and the fire continued unabated. During the late 1930s considerable training was required before pilots could be persuaded that instead of diving to try to "blow the fire out" they must slow down, feather the propeller, switch off fuel and oil supplies and close intakes before firing the extinguisher. The reasons for this were by no means as self-evident then as they are now. Nevertheless, a Graviner report dating from World War 2 suggests that a single control should be provided for completing all these vital actions in correct sequence. For a variety of reasons



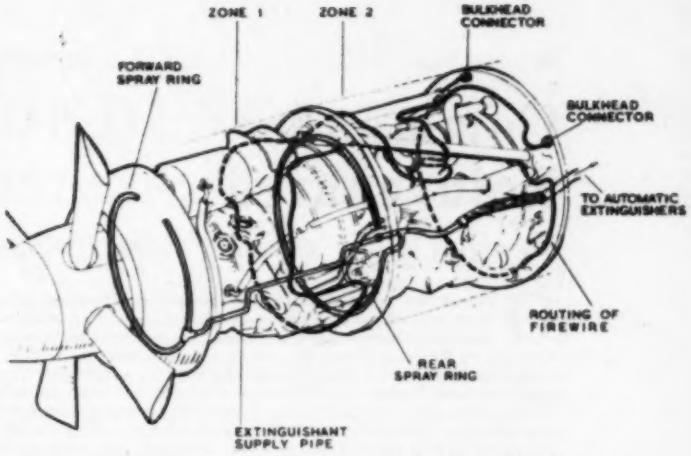
Crashtrip element, showing disposition of the three metal blades separated by rubber blocks. They are forced together by an external pressure of 50 lb

relatively little has been done towards achieving this end, and the nearest approach is generally the careful distribution of controls for each successive operation in a logical position and sequence on the instrument panels. There is still considerable opposition to the provision of a single "panic handle" for use when an engine fire occurs, and one of the most notable contributions to correct fire drill has been the incorporation of the fire-warning light within the feathering or extinguisher button.

The extinguishing system itself generally consists of special fluid contained in a cylinder pressurized with some inert gas such as dry nitrogen, discharging either through a spray ring or one or more nozzles, as appropriate to the particular fire risk. Much wartime research went into discovering the exact origin of in-flight fires and the proper positioning of distribution systems. The fluid now most generally used is methyl bromide, though chloro-bromo-methane (known as C.B.) is now being increasingly adapted. Industrial applications also use CO_2, though this is generally out of favour for airborne use because the containers are heavy. Graviner make two sizes of containers holding respectively 6 lb or 12 lb of methyl bromide or 7 lb and 14 lb of C.B. A third and much more expensive fluid, called bromotrifluoromethane



In the unit-resetting fire detector the high-expansion barrel expands to stretch the low-expansion bow and close the electrical contacts at a preset temperature



Graviner Firewire sensing elements (heavy solid and dotted lines) surrounding a Rolls-Royce Dart engine. Extinguishing fluid is discharged through the two spray rings

("bromotri"), is now being requested by some operators, particularly in the U.S.A.

The Graviner bottles, some of which are now being made of steel, are cylindrical in shape and generally mounted vertically so that transverse acceleration during a crash-landing should not force the fluid against one wall and allow the pressurizing gas, instead of the fluid, to vent into the discharge pipes. Other bottles have been developed to work in any attitude. Actual discharge is achieved by breaking a leak-proof diaphragm with an explosive charge. Visual indication is provided when the bottle has been fired. A twin-engined aircraft will probably carry one bottle mounted as close as possible to each engine, a cross-feed being arranged so that a second shot can be applied to a burning engine by "robbing" the bottle on the other side.

Graviner are also working to apply the explosion-suppression technique to engine-fire extinguishing. The possible advantages are that a finely atomized blast of extinguishant could be spread over an engine in a matter of milliseconds even in high wind-blast conditions. Distribution would be improved and a smaller quantity of fluid required. Pressure bottles and long pipe-runs would be unnecessary, but there are problems connected with the resistance of the detonators to high temperatures.

Although fire extinguishers are not normally set to discharge automatically in flight, they should discharge in such a manner during a crash landing to put out or forestall fire. Some other emergency services should also be automatically operated, and such action is best initiated by switches sensitive to sudden deceleration or to forceful contact with the ground. Graviner produce switches of both types. Their first inertia switch dates from the company's earliest days and was designed to make an electrical contact following a given acceleration in any horizontal direction. Later, requirements stipulated a reaction only to fore-and-aft deceleration. Graviner switches have an inertia mass which will force an accurately compressed leaf spring to overcentre and make a circuit at a given acceleration. The compression of the spring may be adjusted to cater for loadings between 1.5 and 12g. Switches are also being produced with a uniform response to both vertical and horizontal acceleration for helicopter and guided-weapon applications. Aircraft services usually initiated by such switches are fire extinguishers and emergency lights, but dinghy releases, emergency radio and escape hatches might also be included.

Some years ago Graviner felt that a method of initiating emergency services in case of airframe contact with ground should also be provided, and for this they developed the Crashtrip. It consists of a deformable housing about 1ft long set in the aircraft skin underneath the nose, fuselage or wing-tips to operate in case of a belly landing or collapse of one undercarriage leg. Inside it, three metal blades separated by rubber blocks will be forced together to make electrical contact under a pressure of 50 lb. A housing contains two separate elements so that a purely local strike from a bird or small object will not set it off. Contact must be made over most of the length of the strip. A 12 V capacitance discharge system is incorporated so that the emergency circuit will be made and held closed even though the strip may be torn away almost immediately it contacts the ground. At 150 m.p.h. it will operate even though it is torn off after scraping for only ¼in.

While production of the devices described above continues apace, research into new methods and equipment is certainly not neglected. Graviner are working on such subjects as investigating the characteristics, from the protection point of view, of kerosine mixed with H.T.P. Fully 30 per cent of the staff at Colnbrook are engaged on research and the aim is always to stay abreast or ahead of the protection requirements as they arise. It is characteristic of the company that new problems are more often appreciated and solved before official requirements are formulated.

Commando Rejuvenated

Norwegian Airline Operating Three C-46Rs

ONE of the latest examples of airliner modification is a version of the Curtiss Commando—the C-46R—resulting from a two-year research and development programme by Riddle Airlines, Inc., of Miami International Airport. It was granted a C.A.A. transport-category Certificate of Airworthiness on March 12, 1957. It is now a C.A.A. rule that all Commandos be modified to comply with transport-category requirements within a reasonable length of time. The C-46R appeared just a year after another Miami-based company's re-engineered version of this two-engined transport, the L. B. Smith Aircraft Corporation's CW-20T, described in *Flight* for May 4, 1956. This is used by several operators, including Transair Sweden A.B., which owns three CW-20Ts and two Super 46Cs—a still later modification of the C-46 by L. B. Smith (see *Flight*, February 21, 1958, p. 255).

Riddle, an all-cargo operator, owns more Commandoes than any other carrier—a total of 35, all of which have now been converted to C-46R standard. The company has also done some C-46R conversions for other operators, and has licensed the American Airmotive Corporation of Miami to do similar work. Four C-46R conversions have been undertaken at Miami for Westair Transport of Seattle, Washington, a "non-sked," and three more for another non-scheduled carrier, the L. and J. Trading Co., of Miami. Owner of the latter concern is Capt. E. E. Jones, vice-president of RANSA (Rutas Aereas Nacionales, S.A.), which operates 13 C-46Rs on cargo services in the Caribbean. American Airmotive has delivered five C-46R freighters to Delta Air Lines, who call them Super D-46s.

Commando conversions produced by American concerns have in the past tended to be of no more than academic interest to operators outside the Western hemisphere, but the C-46R is an exception. Riddle Airlines have signed an agreement with the Officine Aeronavali organization of Venice whereby the latter will undertake C-46R conversions for customers on this side of the Atlantic, and already three have been completed for Fred. Olsen Airtransport, Ltd., of Oslo. These aircraft entered service at the beginning of this year and are used for such tasks as the transport of ships' crews and ships' machinery, the flying of flowers from the south of France to Scandinavia, and carriage of tourist parties. Each C-46R is fitted with 50 Payloader seats (in four-abreast rows) which can easily be folded against the walls to permit carriage of an all-cargo load; or various combinations of passengers and freight can be carried.

The C-46R cruises at about 30 m.p.h. faster than the "ordinary" Commando, and can carry about a ton of extra payload. Maximum take-off weight has been increased from 45,000 lb to 50,000 lb, and the cruising speed is now 225 m.p.h. at 10,000ft; maximum range is 1,600 miles. Empty weight of the C-46R as a freighter, is approximately 29,000 lb, or 31,500 lb as a 50-passenger aircraft. Accommodation can be provided for up to 62 passengers, and the aircraft can fly from New York to Miami (Riddle's most important route) non-stop in 4 hr, 50 min with 50 passengers or 13,500 lb of cargo; this time is an hour shorter than that of an unmodified C-46 carrying only 11,500 lb of cargo. Riddle's operating costs of the C-46R have gone down from about 11 to 9 cents per short-ton mile.

The modified aircraft is powered by two 2,100 b.h.p. (max. take-off) Pratt and Whitney R-2800C or R-2800-34 Double Wasps, instead of the R-2800-51 or -75 versions of this engine normally fitted to the Commando. The newer engines provide additional power to bring the C-46R up to C.A.A. requirements for take-off and climb. Sea-level rate of climb at 50,000 lb is 1,140 ft/min, or 315 ft/min under the same conditions with one engine out and airscrew feathered. At a height of 10,000ft rate of climb is 730 ft/min. Service ceiling is 22,000ft. At sea level the take-off distance to reach 50ft is 3,080ft, which is increased to 5,480ft if an engine failure occurs at 115 m.p.h. Landing distance from 50ft is 3,462ft at the maximum landing weight of 48,000 lb; zero fuel weight is 47,130 lb.

C-46R cowlings can be recognized by repositioned cooling gills and enlarged ducts for carburettor and air cooler

"Flight" photograph

A new, secondary firewall of stainless steel now isolates the engine accessories from the power section. An Edison "continuous-wire" fire-detection system is fitted, together with a Walter Kidde CF3BR extinguisher system. All emergency wiring in fire zones is now fireproofed, as are the fuel and oil lines. Ignition analyzer systems are installed to simplify fault-finding, and fuel consumption is reduced by the use of fuel-flow indicators and carburettors with manual leaning-off control. The latest-type b.m.e.p. gauges are installed to measure power output. Engine operating temperatures are controlled by micro-positioning cooling gills which are now mounted on top of the cowlings.

To bring down operating and maintenance costs, off-the-shelf production items have been employed wherever possible, and the new powerplants have a longer inter-overhaul period. Accessories maintenance is made easier by larger accessory-compartment doors. Suggestions from Riddle Airlines pilots have been incorporated in a completely redesigned instrument panel, which has a new lighting system including red night-lighting. Extra emergency fuel and hydraulic pumps have been installed. New Janitrol heaters are employed, giving 100,000 B.Th.U. for the cockpit and 200,000 B.Th.U. for the cabin. Improved radio and radio-navigational equipment has been fitted. Wheels and brakes are now of improved B. F. Goodrich type, and an electrically powered auxiliary hydraulic pump enables adjustments to be made to the various hydraulic components without the use of an external hydraulic power source.

The C-46R has a roomy cabin, measuring 48ft long × 9ft 8in maximum width; the maximum floor width is 9ft 1in. Total volume of the main cabin is 2,300 cu ft and total floor area 392 sq ft. There are two main doors, and these open either inwards or outwards to provide an entrance 7ft 11½in wide × 6ft 6½in high, tapering to 5ft 6½in. The floor sill is 7ft 6in above ground and, if desired, doors of greater width can be incorporated. When covered with ¼in plywood the floor can take a maximum loading of 185 lb/sq ft, and plywood can be attached to the fuselage under the cargo doors to minimize damage if a fork-lift truck is accidentally driven into the side. Freight-lashing points are incorporated in the fuselage frames as well as in the floor. There are two under-floor cargo holds forward and aft, each served by a 41in × 38in door and with capacities of 197 and 235 cu ft respectively. Maximum loads of 3,450 lb (forward), and 1,750 lb (aft) can be taken.

Mr. Chalmers H. Goodlin has been appointed exclusive licensee for the C-46R in Europe, Africa and the Middle East by Riddle Airlines, and is responsible for conversion work at Venice. In addition, Pelham Aircraft, of New Rochelle, N.Y., will act as the U.S. representative for Officine Aeronavali. M. J. H.

Passenger accommodation allows for the installation of up to 62 seats (50 is the usual complement). For freighting, typical payload is eight tons at 300 miles and six tons at 1,000 miles (Right) the panel has been completely redesigned to incorporate full dual instrumentation, red "eye-brow" lighting and automatic pilot

"Flight" photographs

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Missiles, Men and Employment

IT is not much over a year since the Soviet Union successfully put the first artificial Earth satellite into orbit; and it is barely seven months since the Minister of Supply, Mr. Aubrey Jones, made his prophecy about possible unemployment (saying that the aircraft industry might drop 100,000 employees in the next five years), less Government spending and the ultimate shrinkage of major airframe and engine firms from 14 and five respectively to a total of four and two. Yet already the combined effect of these two most critical events has been felt in the industry by both employer and employee. Some go-ahead firms have announced their amalgamation plans; and, according to recent Ministry of Labour figures, nearly 12,000 workers lost their jobs in eight months. It seems, at this rate, that the Minister's estimate may regrettably prove accurate by 1963.

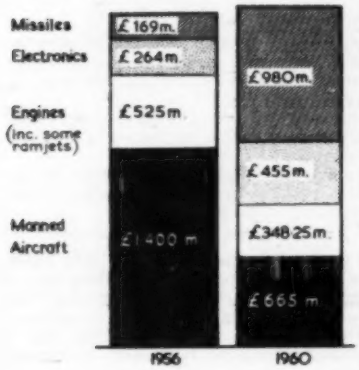
Far more alarming, however, than this persistent downward trend of monthly employment figures is the fact that our top aircraft-manufacturing allies—the U.S.A., France and Canada—have the same disturbing symptoms in their dwindling employment totals. Letters from colleagues already settled in North America tell the writer of a continued recession in their aircraft firms. One well-known Long Island factory laid off no fewer than 250 draughtsmen after first offering them alternative jobs as riveters on the night-shift.

For a would-be emigrant from Britain such news naturally dampens enthusiasm for trying one's luck overseas. A family man, in particular, would be wise to seek more information. The following is the result of my own enquiries from official sources in London:—

Country	Total Employees*		No. of Major Firms	
	Oct. 1957	June 1958	Airframe	Engine
United States... ...	847,000	761,400	12	4
Great Britain... ...	261,500	249,600	14	5
France...	81,000	74,600	5	3
Canada	22,500	20,700	3	2

*Includes minor firms and equipment manufacturers.

The commercial attachés and civil air attachés at the U.S. and French Embassies realistically attribute their aircraft-industry lay-offs and cancelled contracts directly to Russia's initial success with satellites and to their own governments' quick appreciation that manned combat aircraft must soon be replaced by guided missiles. The U.S. has been rapidly transferring its defence expenditure to this pattern for the past two to three years. The accompanying bar-chart shows the trend comparatively.



France, whose £369m military-aircraft programme for 1958 has been slashed by £42m, expects that 20,000 of her 80,000 aircraft workers will be laid off this year. Only recently Canada announced that in the first three months of the present year British emigrants numbered fewer than a quarter of the total for the corresponding period last year. It would seem that news of the current North American recession has already discouraged the faint-hearted.

The Government's rumoured inclination to buy American prop-jet freighters for our Army's "fire-brigade" duties could have been avoided if this obvious weakness in transport aircraft had been spotted during the Suez crisis. An order placed *then* for pure-jet transports of the HP.111 calibre would have given us work and the ability to quell fires 4,000 miles away in 6½ hours' flying-time!

Perhaps, however, our phenomenal success with the launch of the Black Knight rocket at Woomera, plus the news that our Fairey Rotodyne is to be built under licence by an American firm, will persuade those who would leave to stay a while.

St. Albans, Herts. WILLIAM RICHARDSON.

Rotodyne Opportunity

WE are all, I am sure, impressed by both the performance and the economics of the Fairey Rotodyne; in fact, as is well known, an airline in Canada went as far as ordering it "off the development board," to coin a phrase. Rarely in aviation history has a small airline ordered an aircraft which is not even assured of existence. Surely this is proof of its worth.

The Minister of Supply does not seem to think so. Isn't it about time that the Government stopped wasting millions on failures, when here is a ready-made success for the offering, a success that could be the greatest thing in British aviation since A. V. Roe built his first aeroplane?

Wembley, Mddx. H. GINSBERG.

[This situation is the subject of new reports: see pp. 818 and 842—Ed.]

Luftwaffe Pilots' Score

IN mentioning Allied *versus* German air victory scores ("Correspondence," *Flight*, October 31), Maurice Austin is stirring up a hornet's nest. I forecast that once the flow of letters on this subject commences it will take some stopping.

You may be surprised to learn that no fewer than 91 German fighter pilots are reputed each to have shot down one hundred or more aircraft during the 1939-45 conflict. To me this seemed ludicrous until I examined the breakdown of these scores in more detail. The case of Oberst Johannes Steinhoff makes a good example. His total number of claimed victories is 166, but of these 139 were Russian machines destroyed on the Eastern Front. In the West his score came to only 27—12 R.A.F. during the Battle of Britain, and 15 U.S.A.A.F. later shot down in North Africa and Italy. During the latter half of 1941 the Luftwaffe destroyed vast numbers of Soviet aircraft, thereby giving a good start to the "hundred plus" aces. It is obvious from contemporary accounts that exaggerated claims were made on both sides, but even if we halve the scores of the top-ranking German pilots, it would still leave a round dozen with over 100 victories apiece.

I think that the claimants should be given the chance of defending themselves, and in the hope that *Flight* is read as eagerly in the messes of the resuscitated Luftwaffe as it is in most other places where aeronautical types relax, I would make the following request. Could any serving or ex-Luftwaffe fighter pilots or Intelligence officers provide us with information on the methods used during the last war for confirming or disclaiming victories? Were camera-gun films always used as the final evidence of a "kill," or was personal observation on the part of the claimant enough to secure official confirmation? Were aircraft destroyed on the ground, or moored balloons, included in a Luftwaffe pilot's score? Do the pilots themselves now believe in the complete accuracy of these figures? Do the headquarters of the Luftwaffe (or our own Air Ministry for that matter) possess any hitherto unpublished records which might add to our knowledge?

Of the "hundred plus" merchants, a surprising number are, or were until recently, still alive. If any of the following read this letter, and would like to put their own point of view, I am sure that *Flight* would provide the necessary space:—

Major Erich Hartmann,* Ritterkreuz mit Brillanten, 352 victories (Mr. Austin quotes 336); Major Gerhard Barkhorn,* Ritterkreuz mit Schwertern, 301; Major Guenter Rall, Ritterkreuz mit Schwertern, 275; Major Wilhelm Batz, Ritterkreuz mit Schwertern, 242; Major Erich Rudorffer, Ritterkreuz mit Schwertern, 222; Oberst Hermann Graf, Ritterkreuz mit Brillanten, 205.

Hauptmann Walter Krupinski,* Ritterkreuz mit Eichenlaub, 197; Major Anton Hackl, Ritterkreuz mit Eichenlaub, 190; Oberst Johannes Steinhoff,* Ritterkreuz mit Schwertern, 166; Generalleutnant Gordon Gollob, Ritterkreuz mit Brillanten, 160; Leutnant Guenther Schack, Ritterkreuz mit Eichenlaub, 160; Leutnant Max Stotz, Ritterkreuz mit Eichenlaub, 150-plus; Major Adolf Dickfeld, Ritterkreuz mit Eichenlaub, 132-plus; Major Hartmann Grasser, Ritterkreuz mit Eichenlaub, 131.

Hauptmann Alfred Grislawski, Ritterkreuz mit Eichenlaub, 114-plus; Oberst Herbert Ihlefeld, Ritterkreuz mit Schwertern, 113; Major Reinhard Seiler, Ritterkreuz mit Eichenlaub, 109; Major Hans Hahn, Ritterkreuz mit Eichenlaub, 108; Hauptmann Viktor Bauer, Ritterkreuz mit Eichenlaub, 106-plus; Oberstleutnant Kurt Buehligen, Ritterkreuz mit Schwertern, 104; Generalleutnant Adolf Galland, Ritterkreuz mit Brillanten, 103; Oberst Josef Priller, Ritterkreuz mit Schwertern, 101; Hauptmann Karl-Heinz Weber, Ritterkreuz mit Eichenlaub, 100-plus; Hauptmann Heinrich Ehrler, Ritterkreuz mit Eichenlaub, 100-plus; Hauptmann Walter Schuck, Ritterkreuz mit Eichenlaub, 100-plus.

Notes. *These men are also serving officers in the post-war Luftwaffe. Ritterkreuz mit Brillanten (Knights Cross with Diamonds) . . . mit Schwertern (with Swords) . . . mit Eichenlaub (with Oak Leaves), are condensations of the full title, e.g., Eichenlaub zum Ritterkreuz des Eisernen Kreuzes being translated as "Oak Leaves to the Knights Cross of the Iron Cross." Swords and then Diamonds would be added for additional acts of gallantry.

[*Continued overleaf*

CORRESPONDENCE . . .

Some of these scores may conflict with published figures—I have seen Generalleutnant Galland credited with 105 victories—but they are to the best of my knowledge correct.

With regard to the rest of your correspondent's letter, in the German propaganda magazine *Signal* for July 25, 1940, there is a coloured plate of a Luftwaffe pilot seated in the cockpit of a Bf109, whilst another sits on the wing holding a falcon. This aircraft has a white fuselage, although the top decking forward of the canopy and the top of the engine cowling is finished brown-grey. The name "Sepp" appears in large red letters under the cockpit. I believe that Luftwaffe aircraft used on the Eastern Front had a winter camouflage scheme involving very light colours, and a number of Me262s were definitely given a whitish spray during the winter of 1944-45.

Volume II of *Royal Air Force 1939-1945*, page 269, states:—

"On 22nd April [1943] they [the Germans] rashly committed a consignment of petrol to Me323s—six-engined, glider-type aircraft which they had previously employed only in small numbers. Several of these huge machines, each carrying some ten tons, attempted the passage under heavy escort. Intercepted over the Gulf of Tunis by seven and a half squadrons of Spitfires and Kittyhawks, the formation was mown down almost to the last aircraft."

Volume III of the same work, page 195, says in connection with the use of Mistel types:—

"Desperate attempts were made by the Luftwaffe to destroy the vital bridge [at Nijmegen]. In these, use was made of "pick-a-back" (Me109s mounted on Ju88s) aircraft. The heaviest blow was struck on the night of 26th September [1944] and during the following day. The attacks were, however, completely frustrated by Spitfires of No. 83 Group, who claimed to have destroyed 46 enemy machines."

As regards the attacks at Nijmegen with Mistel composite aircraft, it is not made clear exactly how many of the 46 enemy aircraft destroyed were Mistels, and no indication is given as to whether they were shot down as single units or destroyed after separation. As far as I know the He111 was never used as the lower component of a Me109/He111 Mistel; after initial success with converted Junkers Ju88A-4 and A-6 bombers, a special batch of 75 Ju88G-1s were converted at Leipzig-Mockau, and a further 25 G-1s were being modified at the cessation of hostilities.

Perhaps the strangest combination ever put into the air by the Germans during the last war was an experiment designed to discover the critical flutter speed which a Me262 wing could attain. Dornier Werke handled this test, which consisted of dropping a full-scale Me262 airframe from a height of 7 km over Lake Constance. The Me262 was mounted under the wing of a Me323 Gigant powered glider, itself being assisted into the air behind a Heinkel He111Z. The test failed after the decelerating rockets and braking parachute fitted to the Me262 failed to operate, the model plunging into the lake with the loss of its recording apparatus.

London, W.4. RICHARD BATESON.

AUSTRIA had a total of 27 aces in the 1914-18 War: i.e., pilots with a victory score of ten or more. Of these, Oberleutnant Frank Linke Crawford scored 23 victories, his last victom being Lt. E. G. Forder. Linke Crawford was himself shot down in flames near his own aerodrome by Maj. W. G. Barker, V.C., D.S.O., M.C., a few days later. Banfield was never an ace under the strict German ruling of ten victories or more, having scored only nine.

As far as my knowledge goes, Linke Crawford might well have flown a Brandenburg D.I "Star Strutter" scout; I have a photograph of him standing by a D.I numbered 65.54 (65.53 was the personal "mount" of his colleague Brumovski (35 victories).

With regard to "unusual" victories in the 1939-45 War, I can offer two items of interest. I have a combat-film shot of the destruction of a father and son combination—Me109F or G on top of a Ju88. The victor was a Mustang pilot of the 9th U.S.A.A.F. over Germany—name unknown. The other item is a contemporary news cutting claiming the destruction of a Heinkel 177 by S/L. C. C. Scherf, D.S.O., D.F.C.—a Mosquito intruder pilot from Australia.

My personal interest lies in the war in the air, 1914-18, and so any correction or variation of these facts would be welcomed by me in the interest of ultimate accuracy. Should Mr. Austin care to borrow my photographs of Austrian pilots, etc., I would be only too pleased to hear from him (c/o the Editor).

R.A.F. Halton. R. BOWYER.

FORTHCOMING EVENTS

Nov. 28. Elstree Flying Club: Annual Dinner.
Nov. 28. R.Ae.S. Graduates' and Students' Section: Annual Dance.
Nov. 28-Dec. 4. Electronic Computer Exhibition, Olympia, London.
Dec. 1. Royal Society of Arts: Cantor Lecture (2), "The Development of the Aeroplane," by Peter W. Brooks.
Dec. 3. Kronfeld Club: "Gliding in Uganda," by Basil Bell.
Dec. 4. R.Ae.S. (Main Lecture, at Birmingham): "Freighters—a General Survey," by E. D. Keen.
Dec. 5. Helicopter Association: Discussion Evening.
Dec. 6. British Interplanetary Society: "Rocket Nozzles and Jets," by E. T. B. Smith.
Dec. 8. Royal Society of Arts: Cantor Lecture (3), "The Future of the Aeroplane," by Eric Mensforth.
Dec. 9. R.Ae.S.: "Application of a Constant Frequency, A.C. Electrical System to Aircraft and Missiles," by S. S. Hall and A. Thomas.
Dec. 9. R.Ae.S. Graduates' and Students' Section: "The Future of the British Aircraft Industry," by E. C. Bowyer.
Dec. 10. British Institution of Radio Engineers (North Eastern Section): "High Resolution Airfield Control and Ground Surveillance Radar," by P. H. Walker.
Dec. 10. Kronfeld Club: "Cambridge University Gliding Club," by Ken King.
Dec. 10. Royal United Service Institution: "With the Army and Royal Air Force in the Middle and Far East," by William Courtenay.
Dec. 15. R.Ae.S.: Discussion on Hypersonic Flow.
Dec. 16. Convertible Aircraft Congress, Philadelphia.
Dec. 17. R.Ae.S.: "Drone Aircraft," by H. G. Conway.
Dec. 17. Kronfeld Club: Christmas Party.
Dec. 18. R.Ae.S.: "Air Traffic Control Over the North Atlantic," by E. W. Pike.
Dec. 31. Kronfeld Club: New Year's Eve Party.

R.Ae.S. Branch Fixtures (to Dec. 5): Dec. 1, *Derby*, "Thrust Reversal for Jet Aircraft," by R. H. Colley; *Halton*, "The Solar System," by S/L. E. A. Newman; *Henlow*, "Long-range Forecasting," by Sir Graham Sutton. Dec. 2, *Luton*, "Satellites," by E. M. Dowten. Dec. 4, *Bristol*, "Britannia—an Operator's Report," by J. E. D. Williams; *Christchurch* (joint lecture with Institution of Mechanical Engineers), "Aero Engines, Past, Present and Future," by Prof. A. D. Baxter; *London Airport*, "Airline Operational Flying," by Capt. W. Baillie.

Contrail Phenomena

REFERRING to the replies in your issue of November 7 to my recent letter, I should be willing to accept the explanation offered by your three correspondents were it not for one occasion when I observed this phenomenon.

Mr. Whitehead correctly states that the sun and the aircraft should be in relatively suitable positions. I fully concur, but on this one occasion the aircraft concerned, again a B-47, was flying due west; I was facing due north, and the time was early afternoon, placing the sun in a roughly south-south-westerly direction, and once more I saw this line preceding the aircraft.

If this is visualized, you will agree that it would be very hard to imagine that it was merely a shadow of the aircraft's contrails, bearing in mind the laws of reflection of light.

Admittedly, this is an isolated occasion but it would seem to contravene the theories expressed by your correspondents.

Ipswich, Suffolk. M. P. HARRIS.

The von Richthofen Book

A TYPESETTER'S error in my letter (page 776, November 14) would appear to make me seem ill-informed. It should read "No Fokker D VII [seven] had anhedral on the top surfaces of the wings or such a rudder profile."

As it reads this statement has been applied to the Fokker D VIII [eight], which aircraft did indeed have a small degree of anhedral on the top surface of its parasol wing.

I admit these Roman numerals are confusing, but they are the correct German nomenclature adopted to contrast with the Arabic numerals used as manufacturers' designations.

Luton, Beds. P. L. GRAY.

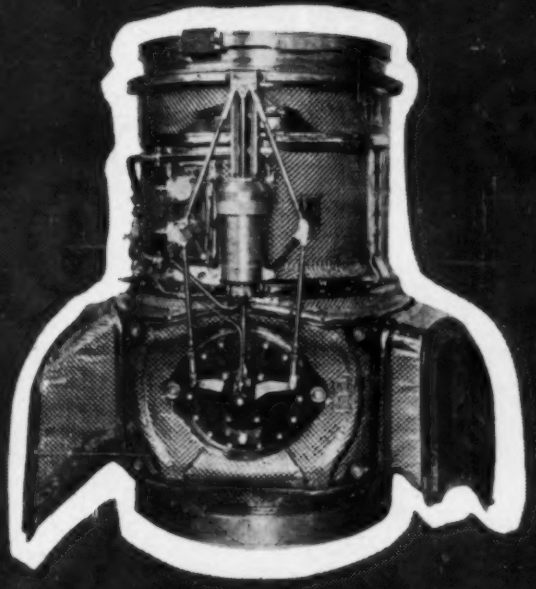
THE comments on the von Richthofen book [reviewed in *Flight* for October 31] seem to typify those who nowadays can be relied on to seize their pens gleefully and tell the world that "the penultimate digit of the serial number of von Mulch's sesquiplane is twice misprinted." Unless one is an archivist, what *does* it matter? This is a beautifully produced book with fascinating photos.

By the way, have you noticed of late how historical experts seem curiously able to dismiss it as a "slip of the pen" when they write, say, "January 1903," instead of "October 1927"? So why worry?

Cerne Abbas, Dorset. MARK KENNAWAY.

"*FLIGHT*" *NEXT WEEK*

On Friday, December 5, our third annual review of the world's missiles will appear. This greatly enlarged special issue will contain descriptions and basic data, illustrated with photographs and scale drawings, and much of the information it offers is hitherto unpublished. In addition, there will be an important detailed analysis of the Thor weapon system, now operational in this country. Regular features will also be included.



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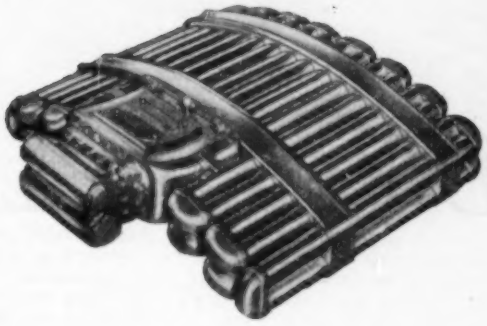

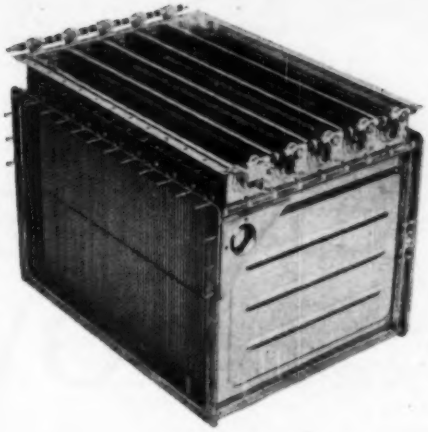

Heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Argosy, the Vickers Viscount and the Handley Page Herald.

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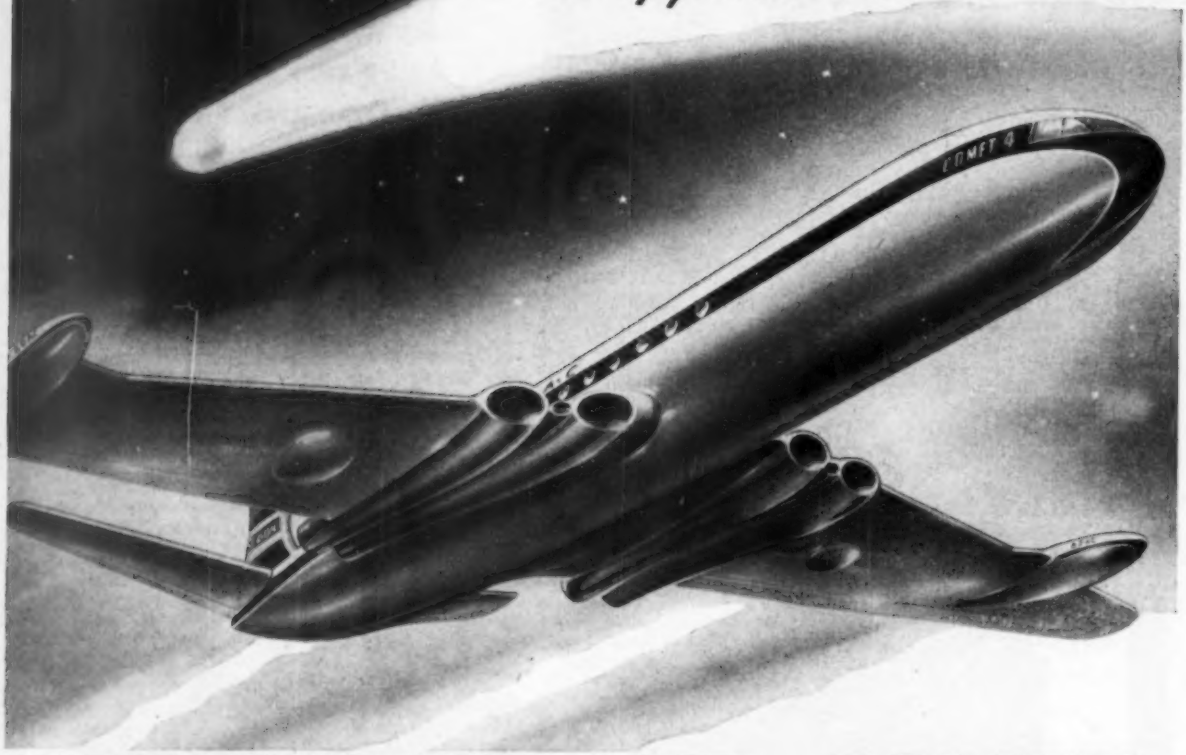

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Straight and Level

LAST week I received two letters which seem to represent the feelings of many firms as Christmas approaches. The first, a circular from a major U.S. aero-engine manufacturer, said:

"Since the Christmas season is approaching, we . . . request your continued co-operation in eliminating the practice of exchanging gifts for business purposes at Christmas time. Letters received from many of you in reply to our announcement of this policy last year indicate complete concurrence . . ."

The second, from a major British aircraft manufacturer, said:

"In common with other firms in the industry we have decided that it is no longer practicable to send out Christmas cards each year.

"Naturally we have been most reluctant to cease to observe this traditional custom but we do feel that within our industry it has over the years developed into an irrationally complicated exercise in permutation. For our part we think that seasonal goodwill will be more tangibly expressed by our making an appropriate contribution to a charitable cause."

I liked the remark of an American businessman on this topic. He said: "I suggest we send a letter to customers explaining why we are not sending a letter explaining why we are not sending Christmas cards this year."

● For my Unhelpful Suggestions file: Vice-Admiral John Hughes-Hallett, speaking in the House of Commons debate on Croydon on November 14:—

"I used to do a bit of flying before the war, and I got quite a lot of fun out of it. After the war, in spite of the fact that I was on the full pay of a senior captain, I found it beyond my pocket, and how other people afford it in these days I would not know. To those young men disappointed in having to give it up, I would say that I took to motor-cycling instead, found it much cheaper and, on the whole, got quite as much fun."

● Back in his Mayfair flat after a month at Cannes, where he arrived just too late for the controversial I.A.T.A. conference on jet fares, is Sir Charles Boost, chairman of Plummet Air Lines.

Last week I asked him for his views on the argument for a fare differential. "My dear fellow," he replied tartly, "I do wish you wouldn't call it a fare differential. It's a *jet surcharge*."

His voice became anguished. "Do you realize what these deadbeat propeller blighters want to do? They want to penalize my jets. It's monstrous, I tell you! Monstrous!" He banged his desk-top so hard that a photograph of Sir Archibald Jogtrotter fell with a crash from the wall. "Ha! ha!" Sir Charles roared, restoring Sir Archibald to his hook—"serves him right." (I should explain that Sir Charles' office is full of portraits of his enemies; Sir Archibald, being chairman of Turboprop Investments, Ltd., is the most hated.)

"Rather appropriate, eh?" he beamed. He went on: "Do you know what that stupid nit says? He says that a fare differential will slow down the equipment race! Steaming great raspberries to that for a start! I ask you, slow down the——*really*! My aim, and the aim of all my Plummeters, is to have an equipment revolution every year. Which reminds me, I've got a lunch date with old Blackout-Jones of Scruggs Aircraft —he's got a super idea for a supersonic airliner . . ."

My word, the bottom really has fallen out of the air freight market, judging from this recent picture taken at Rome. Mind you, there usually is a bit of a recession at this time of the year, and you can't expect the airlines to buy specially scaled-down handling equipment just for the "trough" months, can you? That would be just too ridiculous. But there is one thing that the airlines could do to make things *look* better than they are. They could pile their excess space high with disused copies of optimistic market-research studies of air freight. There are plenty of them

● You may have seen *Flight's* recent analysis of the amount of new runway-extensions required by the Boeing 707 and the DC-8. Out of 204 world airports 190 were reckoned to require extending—by about 130 miles in all.

But no mention was made of the fact that *one airport has actually decided that its runway must be shortened.*

It's the truth—Honolulu's 13,100ft east-west runway is being shortened by 600ft. This, apparently, is to provide the necessary clearances for a new instrument landing system.

● A B.O.A.C. captain has kindly sent me clippings from some Sydney newspapers. Reporting the above-named study, and noting that all Australia's runways were estimated to be too short, they quoted the comments of Mr. C. O. Turner, chief executive of Qantas. Mr. Turner said that his 707s "weighed 25 tons less than those mentioned by *Flight*," and that it was "ridiculous" to say that the ability of airports to take the new jets had been "completely disregarded" by airlines. Again, a Pan American spokesman was quoted by the *Sydney Morning Herald* as saying: "*Flight* based its report on the assumption that P.A.A. would load the jets to maximum gross weight."

We very carefully did *not* assume maximum weights, and I suggest that the 9,000ft take-off field length we did assume is moderate even for the lightest big jets. Indeed, the C.A.A. now requires a 10,300ft field-length for the smallest Boeing. And we *didn't* say the airlines had completely disregarded the runway problem—we said that they took it for granted that someone would pay for the necessary improvements. Is it ridiculous to say this, Mr. Turner?

● I read somewhere the other day about a woman who worked as an instrumentation specialist at Patrick Air Force Base, Florida, and who was dedicated to her job. She died of cancer, and her last request was carried out shortly after the funeral. Her ashes were fired in a Bomarc 40,000ft over the Atlantic and were scattered as the missile exploded.

The propriety of such a rite is a matter of personal feeling. Personally I feel faintly sick.

● Several pilots have ejected from aircraft on the ground in seats not designed for this stringent requirement. In other cases seats have fired of their own accord while the aircraft was breaking up during a crash landing. Some of the pilots have survived, but the majority have not.

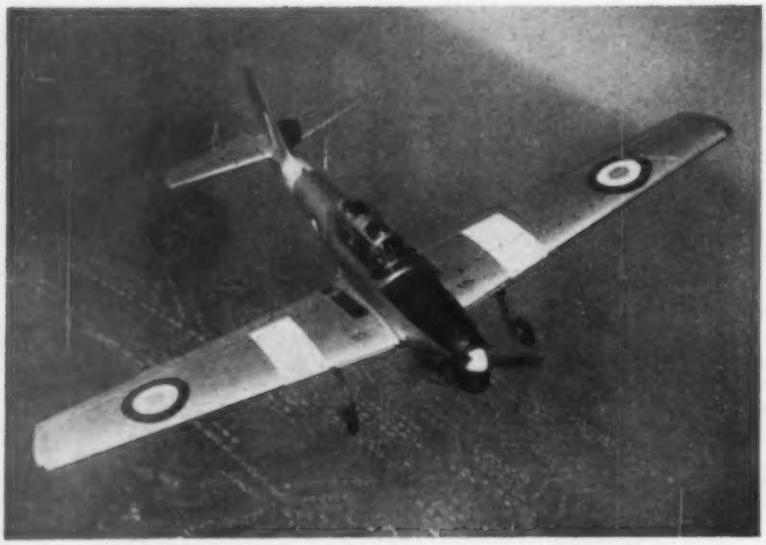
This leads me to quote from the U.S. Navy *Naval Aviation News* the amazing story of an A4D Skyhawk pilot whose engine flamed out at 400ft and 125 kt while he was preparing to land. Resisting an impulse to eject immediately he landed straight ahead in open country with undercarriage down.

Under the estimated 40g impact the seat broke loose, fired, rose about 20 feet, somersaulted, and by a miracle landed upright 50ft ahead of the aircraft. By another miracle the harness release failed to fire after ejection, retaining the pilot in his seat. He unstrapped himself and walked away.

In this case three things failed: the engine, the ejection-seat mounting, and the harness release. Two of these were safety devices.

● Quote from the Minister of Transport, Mr. Harold Watkinson: "It's only when you're spouting that you get harpooned."

ROGER BACON



A Chipmunk of No. 1 Air Experience Flight, based at Biggin Hill, flying in typical November smog with an A.T.C. cadet (in the rear seat) receiving air experience

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Missile Squadrons

WHEN the Duke of Edinburgh visited R.A.F. North Coates on November 19 he was told by the A.O.C-in-C. Fighter Command, Air Chief Marshal Sir Thomas Pike, that units equipped with Bloodhound were by Air Council decision to be called air defence missile squadrons. The first, at present forming at North Coates, would formally come into being on December 1 and be known as No. 264 Air Defence Missile Sqn. Further defence units will similarly take the numbers of former Fighter Command squadrons, No. 264 having disbanded at Middleton St. George last November when equipped with Meteor N.F. 12s and 14s. Intermediate-range missile squadrons, the first of which (No. 77) was formed at Feltwell last August, have former Bomber Command squadron numbers.

Senior Posts

TAKING over as A.O.C. No. 23 (Training) Group on December 1, with the acting rank of air vice-marshal, A. Cdre. Colin Scragg began his R.A.F. career as an aircraft apprentice in 1924. He later became a sergeant pilot, taking part in pre-war Hendon aerobatic displays with No. 1 Sqn. and the C.F.S., and was commissioned in 1938. During the war he served on bomber operations with Nos. 103 and 166 Sqns., being shot down and taken prisoner in 1944 while commanding the latter squadron. He has been Director of Operational Requirements (B) at Air Ministry since December 1955, is a C.B.E. and holds the A.F.C.

A. Cdre. Scragg is being succeeded from December 15) by A. Cdre. R. N. Bateson, leader of the famous wartime Mosquito attacks on three Gestapo headquarters.

When commanding No. 613 Sqn. he led it on April 11, 1944, in the precision attack on Gestapo H.Q. at The Hague; then a year later, in command of No. 140 Wing, he led it on similar operations against Gestapo headquarters in Copenhagen and Odense. He was awarded the D.S.O. and Bar, and had earlier (in January 1941) won the D.F.C. for his leadership of No. 113 Sqn. on Blenheim operations in the Middle East. He has recently been taking the 1958 course at the Imperial Defence College, and last April was appointed an A.D.C. to the Queen.

Air Defence Director

STATION commander at R.A.F. Leeming since early last year, G/C. J. M. Thompson is to become Director of Air Defence at Air Ministry on December 1. He succeeds A. Cdre. S. C. Widdows, D.F.C., who is leaving the Service.

G/C. Thompson commanded No. 111 Sqn. during the Battle of Britain, winning the D.F.C.; then after going to Malta in July 1942 he won a Bar to the D.F.C. and the following year was awarded the D.S.O. He also holds the Belgian Military Cross (having commanded a Belgian fighter squadron, No. 350, in 1941) and the A.F.C., and in 1955 was made C.B.E.

Cadet Flying

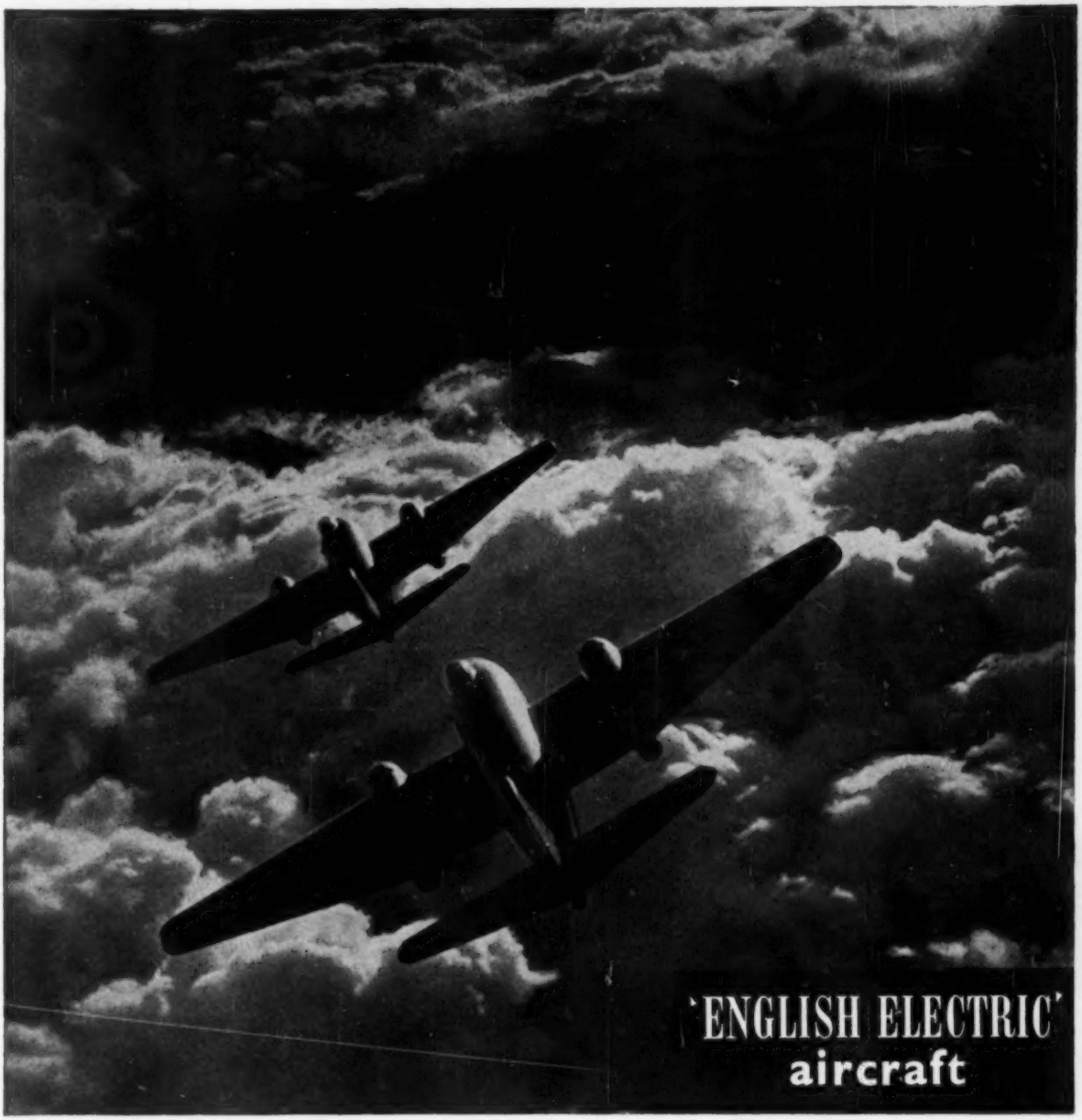
SOME months ago Home Command conceived the happy notion of forming a number of independent flights for the purpose of giving every A.T.C. and C.C.F. air branch cadet at least half-an-hour's flying each year. About 100 Chipmunks were allocated to the scheme and ex-Service pilots were invited to volunteer to fly them. Thousands of pilots came forward and there was no difficulty in manning the flights.

Since there are some 30,000 cadets in the country, the Chipmunks will have to be kept busy to get everyone into the air for his half-hour and the Air Experience Flights are therefore in the enviable position of being encouraged to fly as much as possible at a time when operational flying in many types of unit is being restricted rather than encouraged.

The biggest of the new units is No. 1

Some of the ten Chipmunks flown by volunteer pilots of No. 1 Air Experience Flight lined up with a group of cadets and some of the pilots at Biggin Hill. Wearing flying overalls is F/O. G. de W. Harries, the regular R.A.F. adjutant, and on his left F/L. F. D. Wolfson, commander of No. 1 A.E.F. Its work is described on this and the following page

"Flight" photographs



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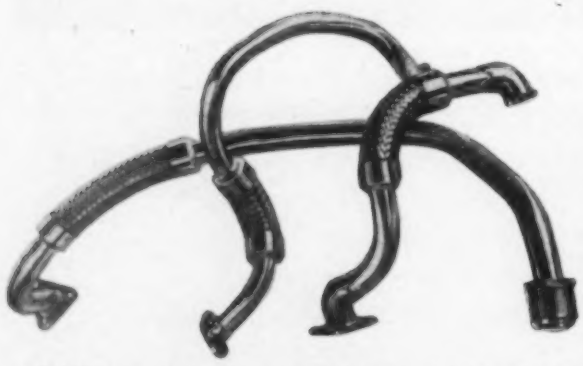

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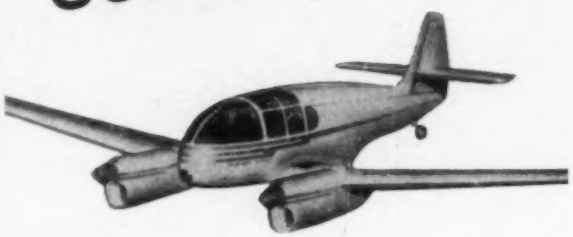

WINNER OVER THE ATLANTIC!

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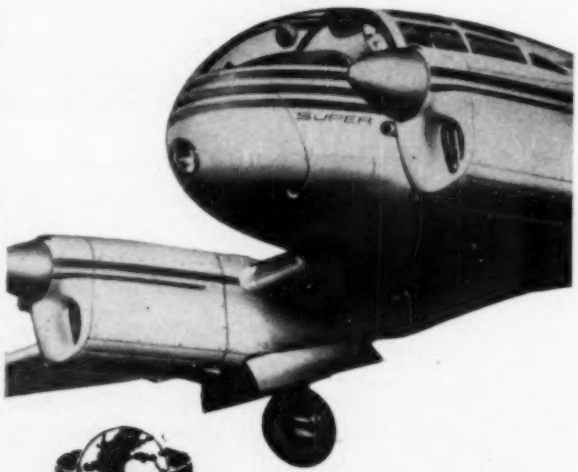

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SERVICE AVIATION . . .

A.E.F. which has ten Chipmunks based at Biggin Hill. This Flight serves the City of London, County of London, Middlesex, Surrey, Kent and West Essex Wings of the A.T.C. and 48 schools, in all representing 20.9 per cent of the British cadet strength. Some 24 pilots, nine of them former members of the R.Aux.A.F. and four from the R.A.F.V.R.(T), attend on a voluntary basis to fly about 140 cadets each week-end and further groups of cadets during the week. No. 1 Flight was formed last September and has now flown something over 500 cadets. (The inaugural tion of the 13 air experience flights was described in *Flight* for September 26.)

The particular attraction of the scheme from the cadets' point of view is that they can be sure of gaining some worthwhile experience and are generally encouraged to fly the aircraft themselves. They can ask the pilot to do either gentle straight and level flying or carry out a complete session of aerobatics. They can see and hear everything that happens, no longer confined to the status of passenger in a type like an Anson. The pilots have a great variety of Service and civilian flying experience. Training standards are laid down and instrument and formation flying is practised. The aircraft are maintained by small teams of regular airmen, those at Biggin Hill being led by Sgt. R. G. Hodgson. Unit markings at No. 1 A.E.F. at present consist of a black nose-cowling (which can be seen in the photograph on page 840), but a badge and motto have also been designed.

Norwegian Commemoration

COMMEMORATING the R.A.F. part in the Norwegian campaign of 1940, plaques of the badges of Nos. 46 and 263 Squadrons are now displayed at the Royal Norwegian Air Force station at Bardufoss in the Arctic circle. These plaques were handed to the C-in-C. of the Royal Norwegian Air Force (Lt-Gen. B. F. Motzfeldt) by the A.O.C-in-C. Fighter Command, Air Chief Marshal Sir Thomas Pike, during a recent visit by Gen. Motzfeldt to Fighter Command headquarters. Air Marshal Sir Richard Atcherley, A.O.C-in-C. Flying Training Command and in 1940 garrison commander of the R.A.F. fighter force at Bardufoss, attended the handing-over ceremony; and so did A. V-M. K. B. B. Cross, A.O.C. No. 3 Group, who during the Norwegian campaign commanded No. 46 Sqn.

At that time the unit was equipped with Hurricanes and No. 263 with Gladiators. Both squadrons flew in to Bardufoss from aircraft carriers and for about two weeks gave air cover to British troops, destroying about 50 enemy aircraft, although heavily outnumbered. They were ordered to evacuate to H.M.S. *Glorious* (the first time Hurricanes had landed on a carrier) but the following day the vessel was sunk by the *Scharnhorst* and *Gneisenau* and all but two of the squadron pilots were lost, the survivors being S/L. Cross and F/L. (now A. Cdre.) P. G. Jameson.

Mr. W. A. S. Lloyd, architect of the St. Clement Danes restoration, with the C. P. Robertson Memorial Trophy presented to him by Sir Lionel Heald (left)

Directing staff and pupils of the Empire Test Pilots School during their recent visit to A. V. Roe and Co., Ltd., when they saw production at Chadderton and also visited Woodford, where they discussed Vulcan flight-testing

Robertson Trophy Award

ARCHITECT of the St. Clement Danes restoration as the R.A.F. Church, Mr. W. A. S. Lloyd has been awarded the C. P. Robertson Memorial Trophy for "the best interpretation of the Royal Air Force to the public" during the past twelve months. It was presented to him at the Air Public Relations Association annual reunion on November 19 by the chairman, Sir Lionel Heald. (See photograph in adjoining column.)

Essay Competition

SUBJECT for the 1959 Gordon Shephard Memorial Prize Essay Competition is:—"So long as the effectiveness of the nuclear deterrent is maintained, it is probable that global war can be averted. But the very success of the deterrent compels Communist Powers to seek to achieve their aims by other methods. It must, therefore, be expected that they will now increasingly concentrate their efforts upon political subversion, economic penetration, and, where the risks to themselves are not too great, indirect military action." Contestants are required to discuss problems likely to arise from such a change of emphasis and to suggest measures which the R.A.F. should adopt to enable it best to meet them. Closing date for essays (which must not exceed 4,000 words in length) is April 30, 1959.

"Depot of Depots"

AFTER forty-two years as a stores depot No. 3 Maintenance Unit is to close down and next Wednesday (December 3) a farewell cocktail party is being held to which the C.A.S. and A.O.C-in-C. Maintenance Command, as well as many other distinguished guests, have been invited.

The unit has been based at R.A.F. Milton, Berks, since 1916; its number (assumed in January 1917) has never been changed, nor has its function—to receive, store, maintain and issue R.A.F. equipment. This record—as the oldest unit with an unchanged location, identity and function—is claimed to be unique in the R.A.F. During its existence No. 3 M.U. has held almost every type of Service equipment except explosives. It was described in 1917 by its then C.O. as "the depot of depots," and his successors—there have been 21 commanding officers—have striven to maintain this title. Civilians have been employed at the unit since 1916, one having been there continuously since that date and ten since February 1919. Their record of loyal service fully justifies the motto on the No. 3 M.U. badge—"*Pace et bello paratus*" ("In peace and war, prepared").

R.A.F. Postings

AMONG recent R.A.F. appointments announced by Air Ministry are the following:—

G/C.s O. Gradon to Air Ministry, for duty in the Department of the Air Member for Personnel; R. J. Rackham to H.Q., British Forces, Arabian Peninsula, for technical staff duties; and A. R. C. Young to the R.A.F. Hospital, Ely, as specialist in radiology.

W/C.s R. J. E. Boulding to R.A.F. Coningsby, for administrative duties; F. J. Mundy to R.A.F. Sopley, to command; J. Rennie to the Ministry of Supply; C. H. Baker to No. 5 (Light A.A.) Wing, R.A.F. Regiment, to command; N. Cameron, as Personal Staff Officer to the Chief of the Air Staff; I. J. De la Plain to R.A.F. Laarbruch, 2nd T.A.F., for technical duties; D. E. Gibbs to No. 71 M.U., to command; H. Harvey to the Ministry of Supply; and F. J. Higham to R.A.F. Waterbeach, to command the Administrative Wing.

IN BRIEF

King Hussein of Jordan has presented the "Independence" Order—highest Jordanian award—to W/C. J. Dalgleish, air adviser to the Jordan Government and pilot of the Royal aircraft when it was intercepted recently over Syria.

* * * * *

The telephone number of the Air Ministry information office in Manchester is now Deansgate 5548.

* * * * *

Home Command won the R.A.F. Inter-Command rugby championship by beating Technical Training Command by a penalty goal (3 pt) to nil at Uxbridge on November 19.

* * * * *

The Marine Craft Unit Efficiency Cup for 1957-58 has been won for the first time by the marine craft section of the R.A.F. Element at the Joint Anti-Submarine School, Londonderry, N.I. Last year's winners, the marine craft section at R.A.F. North Front, Gibraltar, were runners-up.

* * * * *

Membership of the R.A.F. Reserves Club is now open to serving officers of the R.A.F. Subscription rates (irrespective of rank) are £5 5s 0d for town members, £2 12s 6d country members and £1 1s 0d overseas members. Application forms may be obtained from the Secretary, R.A.F. Reserves Club, 14 South Street, Park Lane, London, W.1.

Seasonal mists at London Airport recently focused attention on the possibility of automatic blind landing as an aid to year-round regularity of operation. (See below: "B.E.A. In Zero-Zero")

CIVIL AVIATION

SUPPORT FOR THE ROTODYNE?

THE future of the Fairey Rotodyne, which has been in some doubt financially, now appears to be more secure. The Fairey company have for a long time spoken of a figure of "about £10 million" as being required to continue development and production.

The Rotodyne has been brought to its present promising state of development under Ministry of Supply contract; further support was first sought by Fairey at the beginning of 1958, and the long delay has been due to negotiations between the manufacturers (including the Eland engine manufacturers, Napier) as to the backing which they were prepared to give to their venture.

According to a report in the London *Daily Mail* last week, Fairey have now offered to invest £2 million and Napier an additional £1 million. The extent of the Government's support is said by the same source to be "at least £2.5 million." This report is neither confirmed nor denied by the manufacturers concerned. While the sums said to be involved are only half that ideally required for full exploitation of the Rotodyne, they are at least sufficient to encourage potential buyers. These include Okanagan Helicopters of Canada, the largest rotary-wing operators in the world, who have ordered one aircraft; J.A.L.; New York Airways; and of course Kaman, potential U.S. licence-constructors of the Rotodyne. (Fairey annual report, page 818.)

B.E.A. IN ZERO-ZERO

DETERMINATION to reduce the effect of weather upon regularity of operation has led B.E.A. to look hopefully at the work of the Blind Landing Experimental Unit at Bedford (described in *Flight* for October 17). Users of short-haul airlines expect punctuality, and by regular operation eventually in zero-zero weather B.E.A. hope both to be able to reduce costs and to increase their competitive appeal.

Lord Douglas, the Corporation's chairman, suggests that an improvement in punctuality and regularity through the winter season might go some way towards reducing the traffic fall-off at this time of year. Writing in the *B.E.A. Magazine*, he says that sufficient progress has now been made for the first steps to be taken towards almost-all-weather operation for airlines; and he appeals for agreement in I.C.A.O. on the ground component of the system and for thought to be given to the degree of multiplication of signalling channels necessary for safety in the airborne equipment. The basic problems, says Lord Douglas, have now been solved; further development requires the co-operation of airport authorities, research departments and manufacturers: "I hope we shall be able to get down to such discussions in this country before long. There is a great deal at stake—particularly for B.E.A."

The Corporation announced last week that the D.H.121, due to be delivered in 1964, will be equipped from the start with blind-landing equipment.

BAHAMIAN SKYWAYS

BAHAMAS AIRWAYS have been having a rough time in recent months. The islands' tourist traffic was given a jolt by the general strike, which led to a sharp fall in revenue for all those dealing in the holiday market. The American recession has also been felt on the islands, for the general level of travel business has failed to reach expectations.

A further complication has been the entrance of a competitor. A locally financed airline, Skyways, Ltd., was established just a year ago and acquired a DC-3 and an L.10 Electra for operating scheduled services between the islands. Last summer Mr. David Brown and Mr. Eric Rylands (the last-named is managing director of the British independent, Skyways, Ltd., which then had no connection with the new Bahamas operator) visited the Bahamas and subsequently acquired control of the local Skyways.

Now, only a few months later, it has been revealed that Mr. Brown and Mr. Rylands have also acquired an 80 per cent share in Bahamas Airways from B.O.A.C., leaving the Corporation with the balance of 20 per cent. Bahamas Airways' three Herons will be replaced by DC-3s "as soon as possible," and these will operate on the inter-island routes and also between Nassau and Florida.

RUSSIAN HELICOPTER SERVICE

ALTHOUGH Aeroflot has had jets in service for over two years scheduled helicopter services—even on a short-term experimental basis, as tried by B.E.A.—seem to have lagged behind (although a Crimean service was forecast in *Flight*, July 4). An announcement by Moscow Radio last week that a regular service between Simferopol and Yalta, using ten-seater Mi-4s, was started on November 22 indicates that this tardiness is now being remedied; it was not, apparently, due to any reluctance to operate revenue services with single-engined helicopters.

The first flight carried passengers who had earlier arrived by air from Kiskinev to spend their holidays on the Black Sea coast. The distance from Simferopol to Yalta is covered in 25 minutes (the bus journey takes four to five hours) at the Mi-4's cruising speed of about 93 m.p.h., but the helicopters must climb to 4,800ft to clear the intervening mountains.

AN UNHAPPY RECORD

A FEW months have still to run before the course of the present airline year can be accurately plotted. But the broad outline can already be discerned, and it is possible to hazard an estimate for the year's progress. World-wide capacity will probably have increased over the year by between 10 and 15 per cent, while traffic has increased by about 5 per cent. The general traffic pattern will be a rise of almost 10 per cent in Europe but of less than 5 per cent in North America. Of the long-haul routes, the North Atlantic will show a gratifying rise of 25 per cent, but elsewhere there will be little or no overall change.

The global average load-factor can be expected to fall, from rather over 57 per cent to just under 55 per cent. So precariously balanced is the industry's financial position that a setback of such slight magnitude as this is critical: at the first of these two levels the world's airlines just managed to make a profit—a paltry 1 per cent on total revenue—but at the second level there is little doubt that the industry as a whole will fail to break even.

Alternative propeller-apparel for the Electra, so far specified only by K.L.M., is this Hamilton Standard 54H60 Hydromatic as used on the Lockheed C-130. Cuffs and solid aluminium blades are distinctively different from the Aeroproducts propeller used in other customers' installations

It's proof like this that sells me the VISCOUNT

Capital Airlines figures emphasise original economy claims of the Viscount 700

These figures are taken from a study of operating costs recently made by Capital Airlines. The original estimates made in May, 1954, are compared with actual costs experienced in service.

Cost per aircraft-hour flown	*Original Estimate*	*Actual 6-months period ended 30th June, 1958*
DIRECT EXPENSE		
Pilots' salaries, travel; engine fuels; hull insurance; etc.	$ 96.15	$ 95.85
Direct maintenance labour, materials	57.76	47.12
Aircraft depreciation	45.91	46.36
Total direct expenses	199.82	189.33
INDIRECT EXPENSES		
Assigned expenses (of all other elements of operating expense allocated to types of aircraft on a formula basis)	$169.52	$169.20
Total operating expense	369.35	358.53
Costs per revenue aircraft-mile flown		
DIRECT EXPENSE		
Pilot's etc.	$ 0.402	$ 0.383
Direct maintenance	0.242	0.188
Aircraft depreciation	0.192	0.185
Total direct expense	0.836	0.756
INDIRECT EXPENSE		
Assigned expense	$ 0.709	$ 0.697
Total operating expense	1.545	1.453

It's experience—backed by figures like these—that is built into the Viscount 810/840

VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART JET-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY ENGLAND

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CIVIL AVIATION . . .

BIG BROTHER

THERE are times when the Civil Aeronautics Board appears to escape from the humdrum business of awarding routes and to enter the wider world of economics and politics. In fact, a study of Board reports will always show that these spheres of activity are unavoidably interwoven: the C.A.B., unlike our own A.T.A.C., is responsible for the formulation of policy and not merely for its interpretation.

At the present time the Board is considering at least three of these more general problems. The most immediate is the scheme put forward by six leading carriers—American, Capital, Eastern, PanAm, T.W.A. and United—to mitigate the damaging effects of strike action. In broad outline, the proposed arrangement is that airlines would take over the services of any rival grounded by strike action. They would retain enough revenue from the operation to cover direct operating costs and pass the balance to the grounded rival.

An even more general problem currently under C.A.B. consideration is the method of remunerating local-service carriers. The Board's staff has prepared a draft scheme to replace the present cumbersome method of fixing mail-rates in accordance with each carrier's overall break-even position. The proposed new system is essentially a replacement of cost-plus by fixed-costs: for each local-service route the Board would set a standard cost, a standard load and a standard revenue-rate. The amount of subsidy for each route would be the difference between standard cost and standard revenue (load times revenue-rate) and would not be altered if actual figures failed to correspond to standard.

Thus, if the carrier managed to improve on standards, the saving would be translated into profit. On the other hand, it would suffer for failing to reach the standard figures. The Board would be covered against setting over-pessimistic standards by a profit-sharing scheme whereby an increasing proportion of profits would have to be returned to the Board once a defined level of profitability has been exceeded.

But neither the strike scheme nor the method for remunerating local services is as basic in character as the General Passenger Fare Investigation. The purpose of this heroic marathon is to ascertain the general fare-level that is in the best long-term interests of both the airlines and the community. Surface competition, public willingness to pay for air travel, inflation, jet operating costs, re-equipment finance, maintaining break-even load-factors: these are only some of the factors to be considered in this labyrinthic equation. The examiner conducting the G.P.F.I. has now heard all outside evidence and was recently briefed by the Board's Bureau of Air Operations; they recommended that fares be reduced by stages to a level somewhere between that ruling at present and that which obtained prior to February when the temporary increase (averaging about 7 per cent) came into effect.

The Board's procedure has recently been described by Britain's Minister of Transport and Civil Aviation as being "elaborate" and "long-winded." But can mature and informed consideration of the sort of problems outlined above be the result of intermittent meetings by three men and a dog?

AIRLINE BEST-SELLER

FEW publications dealing with air transport can equal the high utilization rates achieved by I.C.A.O.'s annual digest of airline statistics. The popularity of this digest, evident from the dog-eared condition of most copies after a year's intensive use, is a reflection of the value of comprehensive, unbiased and accurate information to an industry which too often has to wallow in a quagmire of misleading (and sometimes spurious) statistics.

The Organization's statisticians do their best to insure that information is available for every airline that flies scheduled services. As airlines frequently err in reporting their own figures, every item is carefully cross-checked, and the information is then presented on a uniform and well-defined basis.

The latest issue, covering the year 1957, has recently been published, and is much improved by concentrating the details for each airline on to a single page. Reference is further facilitated by the use of clearer headings.

I.A.T.A. also publishes an annual digest of airline statistics, and although this gives less detail than the I.C.A.O. version, and is limited to the activities of Association members, its publication in July—three months before the appearance of its rival—renders it particularly valuable.

MEXICAN MERGER

RUMOURS have been circulating for some weeks (see *Flight*, November 14) to the effect that Compania Mexicana de Aviacion and Aeronaves de Mexico are planning a merger. Though officials of the two airlines are denying any form of financial association (although PanAm, of course, has an important share-holding in each), recent operating changes show that Mexico's leading carriers are working very closely together.

A joint advertising programme has been launched, and arrangements have been made between the two companies to pool ground facilities, to accept each other's tickets, and to co-ordinate certain competitive routes. Aeronaves' two Britannias are to be taken off the Mexico City - New York service and put instead on to Mexicana's routes to Chicago and to Los Angeles. The three DC-7Cs used by Mexicana on these services will be sold to Northwest, their place being taken by three DC-6s from Panagra.

This picture records the event described by the Minister of Transport—"without disrespect to the S.B.A.C."—as the air occasion of the year—the annual dinner of the British Independent Air Transport Association, which this year took place at the Dorchester, London, on November 12. About 275 people were present; here are the names of the 36 people on the top table, reading from the top left to the right:—

Maj-Gen. C. G. B. Greaves (Eagle); Maj-Gen. S. H. M. Battye (War Office); Mr. L. E. Moore (Dan-Air); Sir George Pirie (Air League); Mr. S. J. Cox (Airways Union); Sir George Edwards (Vickers); Mr. L. C. Hunting (Hunting-Clan); Mr. A. F. Burke (president, S.B.A.C., also D.H. Aircraft); Sir Wavell Wakefield (Skyways); G/C. C. A. B. Wilcock (Derby Aviation); Sir Gerard d'Erlanger (B.O.A.C.); Mr. G. H. Freeman (Transair); Mr. George Ward (Air Minister); Mr. F. A. Laker (Air Charter); Lord Terrington (A.T.A.C.); Mr. E. Rylands (Skyways, and recently appointed first president of B.I.A.T.A.); Mr. Harold Watkinson (Minister of Transport); Capt. T. W. Morton (Morton Air Services and chairman of B.I.A.T.A.); Lord Winster; Mr. C. J. Stevens (B.K.S.); Mr. Christopher Soames (Under-Secretary for War); Mr. H. Bamberg (Eagle); Air Marshal Sir Geoffrey Tuttle (Air Ministry); Mr. M. D. N. Wyatt (Airwork); Mr. A. H. Milward (B.E.A.); Mr. M. H. Curtis (Hunting-Clan); Mr. P. G. Masefield (Bristol, chair occupied later); W/C. H. A. Roxburgh (Derby). Also at the top table but out of the picture, left to right: Mr. M. M. V. Custance (M.T.C.A.); Mr. R. L. Cumming (Airwork); Mr. G. de Freitas, M.P.; Mr. F. H. Wilson (Starways); Sir John D'Albiac (A.T.A.C.); S/L. R. J. Jones (East Anglian); Sir John Lang (Admiralty); Mr. L. B. Elwin (Cambrian)

CIVIL AVIATION . . .

LEFT HAND, RIGHT HAND

TWO recommendations of first importance to the future pattern of air traffic control are being hammered home on every hand by those responsible for civil air transport: (1) "see and be seen" has been proved to be unsafe and can no longer be tolerated, and (2) there is urgent need to co-ordinate military and civil aircraft movement on a world-wide basis; the left hand *must* know what the right hand is doing.

In their meeting at Delhi (reported in *Flight*, November 7) I.A.T.A. was quite specific on both scores: a programme of measures was contrived to replace "see-and-be-seen" by positive, unified control within five years, and resolutions were passed urging I.C.A.O. (for action by governments) to take "every available means to provide a system of positive airspace control over national territory and the high seas . . . under a single air traffic control authority in the respective control areas," and demanding also a Collisions Convention governing both civil and military aircraft, the recommendations to be ratified by the states concerned.

The cry for joint control, strongly and already effectively pressed in the United States, has been widely taken up in Europe, where the accident to the B.E.A. Viscount at Nettuno in October underlined a truth which most pilots have already long appreciated: that co-ordination of civil and military traffic in Europe, and Italy in particular, is far from adequate. Lord Douglas, writing in the B.E.A. magazine, commented recently: "I believe that we should not be satisfied with anything less than a unified system which extends throughout Europe in such a way as to make mid-air collisions of this kind a virtual impossibility in the future."

Meanwhile, criticisms of Italian traffic control, particularly on the grounds that airports and control towers are operated by the Italian Ministry of Defence and that there is no separate civil aviation department, continue to be strongly voiced. "It seems that one of the exercises preferred by military aircraft," the Italian magazine *Epoca* quotes Alitalia pilots as saying, "is that of intercepting—that is, to approach as close as a few metres to a civilian aircraft over some part of Italian territory [in order] to ascertain its nationality."

The observation is confirmed by pilots of other airlines. An Air-India captain recently told *Flight* that he had on more than one occasion been buzzed and formated upon by jet fighters, and "just for practice" been signalled to land. Reaction in Italy seems to be that responsibility for civil aviation should be taken from the defence department and placed under the control of a separate organization. Senator Guiseppe Caron, Italian Under Secretary for Civil Aviation, is quoted as saying: "The jurisdiction of the Ministry of Defence over civil aviation has absolutely no justification." Speaking of the complaints by Italian and foreign airline pilots, he said: "Yes, they have arrived and are arriving, but I would like to say that this is common to all countries and even more in countries more aeronautically developed."

The question of combined control has recently also been raised in the United Kingdom. Last week, Mr. Frank Beswick (Lab., Uxbridge) asked in the House of Commons: "Is it not a fact that . . . we can no longer afford to have two different controllers looking after aircraft in the same airspace?" For the Government, Mr. Airey Neave, Joint Parliamentary Secretary to the M.T.C.A., replied that, with the Service Departments, a jointly manned single air traffic system was being built up: "That is the first point. Secondly, and it is a matter of some importance, within the controlled airspace in certain sectors of the London Control zone, there is one man in control, whether he is civil or military."

Although under the pressure that is now being applied to them I.C.A.O. have yet to pronounce officially on unified control, further recommendations for tightening A.T.C. procedures were announced on November 20, at the end of a session of the Rules of the Air, Air Traffic Services and Search and Rescue Division.

As a first step towards elimination of "see-and-be-seen," an extension of V.M.C. limits to 5 n.m. visibility (as now in operation in the British Isles) has been proposed; increasing the requirement further would, it is suggested, unfairly penalize the operation of slower aircraft in the lower airspace, but the division recommends that all flights above 20,000ft should be under ground control, which should carefully co-ordinate civil and military aircraft movements. Other important recommendations refer to both pilots involved yielding right of way when the aircraft are on collision courses, doubling the present vertical separation above 29,000ft or less, and filing flight plans on advisory routes. Automatic distress radio-beacons were also recommended for life rafts and aircraft flying across areas where search and rescue is difficult.

A recent visitor to Filton was Dr. Josef Rust (left), Deputy Defence Minister of the West German Government. He is seen after inspecting a production Britannia with Sir Matthew Slattery, chairman of Bristol Aircraft, Mr. C. McFarlane, M.o.S. representative in Germany, and Mr. D. S. Stewart, Britannia production manager

C.P.A.L.'s TRANSCONTINENTAL EAGERNESS

SOME measure of C.P.A.L.'s eagerness to operate transcontinental Canadian domestic services, and of T.C.A.'s opposition to the idea, has been strongly evident during the past few weeks. The Canadian Air Transport Board has been conducting hearings into the whole question of Canadian domestic competition. A summary of an independent survey into this matter, ordered by the Canadian Government, appeared in *Flight* for August 22. The author was Mr. S. F. Wheatcroft.

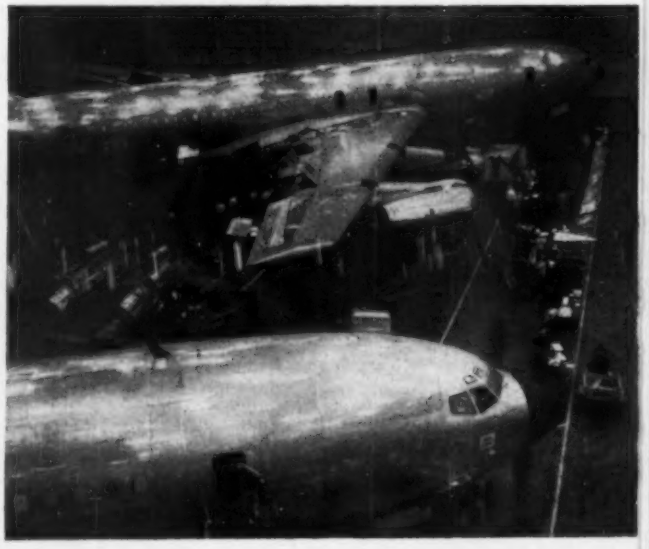
There are not many new ideas in the C.P.A.L. evidence, but certain points of emphasis are of particular interest. For example, C.P.A.L. claim that, soon after they filed their application to operate transcontinental services on November 28, 1957, T.C.A. began service on three of the proposed segments—suggesting how even threatened competition can improve the standard of service to the public.

C.P.A.L. propose, "and will be prepared to fly forthwith," three transcontinental DC-6B services at a daily frequency between Vancouver and Montreal via: (1) Winnipeg and Toronto (2) Edmonton and Ottawa (3) Calgary, Winnipeg and Ottawa. This is a revised proposal in view of T.C.A.'s introduction of service on other sectors mentioned above.

C.P.A.L. have presented an estimate of revenues and expenditures operating five DC-6Bs on the above three routes: the result, they reckon, would be a profit of more than $600,000 in the first year.

The use of DC-6Bs is proposed because this aircraft enables long flights and medium flights to be operated economically, and it will be "completely competitive" at least until 1961. C.P.A.L. have studied several new types, availability of these being as follows: DC-8, July 1960; Caravelle, November 1959; Comet 4, October 1959; CL-44, November 1960.

C.P.A.L.'s evidence suggests that T.C.A. might have to cut back their Vanguard order if C.P.A.L. are permitted to compete. The



PanAm's first Boeing 707-320 Intercontinental (Pratt and Whitney JT4A-3s) was nearing completion when this photograph was taken. It should be rolled out within the next few days. Seventeen are on order for PanAm and the first should be delivered next summer

Proud moment for Fokker at Amsterdam was delivery of the first two Friendships to Aer Lingus on November 19. The aircraft were received by Capt. J. C. Kelly-Rogers, the airline's deputy general manager, and a champagne naming-ceremony was performed by Mrs. Gallagher, wife of the Irish Minister at The Hague

airline's evidence states that T.C.A. intends in 1960 to "re-order Vanguards and DC-8s for delivery in 1962." Competition, if introduced now, would enable T.C.A. to "adjust" their present aircraft commitments now—"when this can be done as economically as possible."

A considerable portion of C.P.A.L.'s evidence has been aimed at T.C.A.'s alleged inefficiency. C.P.A.L.'s director of economic research, Mr. W. J. Stenason, has compared T.C.A. with Delta, Braniff and Northwest, these American airlines being suggested as comparable with T.C.A. The conclusions of his survey are that "$17 million is a reasonable estimate of the annual inefficiency of T.C.A."

This estimate, though carefully qualified and supported by well documented argument, is strongly contested by T.C.A. Curiously—whether it is a reasonable estimate or not—it appears to be a negative way of promoting C.P.A.L.'s case for being allowed to compete transcontinentally.

EXIMBANK AID ALITALIA

A FEW weeks ago the Institute Mobiliare Industriale, Italy's state-owned investment agency, revealed that Alitalia's expansion programme over the next five years would be guaranteed to the tune of L.55,000m (£32m). Not all the risk will be borne by the I.M.I., however; subsequent reports show that three-quarters of the dollar expenditure involved in the purchase of DC-8s will be covered by American organizations.

The $24m to be spent in the U.S. relates to four DC-8s and one Link flight simulator. The Italian Government has guaranteed a cash down-payment of $6m, and the remaining $18m will be financed by the Export-Import Bank ($13.7m), Douglas ($4.1m) and Link ($0.2m). The ExIm contract stipulates a 6½-year repayment period ("13 semi-annual instalments") starting in 1961.

The Rolls-Royce Conways specified for Alitalia's DC-8s are not included in these negotiations.

FAITH AS YET UNREWARDED

THE first independent to appear on the Britannia order-book was Hunting-Clan. This order, for two 310s, was placed two years ago (one was ordered in September 1956, the second in December 1956). The order seemed to be a sheer act of faith in the future, because at that time opportunities for the use of such expensive, highly competitive equipment appeared limited.

Now the future has arrived, and the time has come for Hunting-Clan to take delivery of the two Britannias. These aircraft, valued at about £2.5 million, are owned by the British Commonwealth and Shipping Company (joint owners, with the Hunting Group, of the airline) and are registered under the name of Clanair.

How do Hunting-Clan propose to use them? The airline can make no comment; but it is clear that behind the scenes during the past months particularly strenuous efforts have been made to create opportunities for the new equipment, including a Hunting-Clan tender for long-term trooping contracts which are linked to the use of Britannias.

Hunting-Clan have also applied to operate Britannias on inclusive tours to Jamaica, Bermuda, the Bahamas, New York and Montreal. This application was turned down as likely to divert traffic from B.O.A.C. In the meantime, the airline's African Colonial coach-services are being operated by Viscounts, and the Africargo service is being flown with newly acquired DC-6As.

Prospects for the utilization of the new Britannias thus appear to be slight, and the faith with which they were purchased two years ago has apparently not been rewarded.

The one glimmer of hope appears, to the outsider, to be the award of a long-term Britannia trooping contract. Here, however, the situation is complicated by the fact that the three Britannia 250s bought by the M.o.S. for trooping by independent operators are not yet allocated by the Government. In the meantime, too, one independent—Air Charter—has actually entered the Britannia operating business by using one of Bristol's surplus 300-series aircraft on a short series of trooping flights to Christmas Island.

AIRWORK TAKE OVER MORTON

PURCHASE by Airwork of a majority interest in Morton Air Services and its subsidiary Olley Air Services has brought two more independent companies under the wing of Britain's oldest independent operator. Organizations which the airline controls, or in which it has a substantial interest, now number seven: Transair, Air Charter, Fison Airwork, Straits Air Express (New Zealand), Commercial Air Services (South Africa) and Morton and Olley. The chairman and managing director of Transair, Mr. G. H. Freeman, also has a seat on the Airwork board.

Between them, the British companies now in the Airwork group operate from London Airport (Airwork), Blackbushe (Airwork), Southend (Air Charter), Stansted (Air Charter's Britannia charter flights to Christmas Island) and Croydon (Morton and Olley), but it is intended to concentrate operations on Gatwick and Southend, the latter airport being devoted only to Air Charter's Channel Air Bridge and coach-air services.

Although hangar space at Gatwick is still limited, Airwork have had overhaul facilities there for many years and Transair are well-established in a modern base with up-to-date facilities for Viscount maintenance and overhaul. It may well have been the urgent necessity to leave Croydon, coming on top of a thin summer season, that forced Morton to look elsewhere for financial assistance, the likely cost of becoming re-established at Gatwick (or elsewhere) having long been a matter of concern to the airline's chairman, Capt. T. W. Morton.

Besides adopting Gatwick as their main operational base Airwork intend eventually to adopt central organizational control, although the process is expected to take some time.

B.O.A.C. ACROSS THE PACIFIC

THE American "foreign air carrier permit" at present held by B.O.A.C. covers a U.S. network stretching westwards only as far as San Francisco. The Corporation has now applied to the C.A.B. for an extension of this network to allow services to continue on across the Pacific to Hong Kong by way of Honolulu, Wake and Tokyo. B.O.A.C. is seeking traffic rights between Hong Kong, which in this context is part of Britain, and San Francisco.

If these applications are granted, B.O.A.C. would become another round-world operator, the route following closely along the course of PanAm's globe-encircling service.

B.O.A.C. can, and do, already claim the "round-the-world" distinction: their partnership with Qantas—who, of course, traverse the South Pacific between Australia and San Francisco—justifies this claim. Now the Corporation intends to become a round-the-world operator in its own right. There is more to the application than the ability to make this claim, however. The Corporation's valuable markets in India, the Far East and Japan are linked with the U.K. via the politically turbulent Middle East, and B.O.A.C. no doubt wish to establish a more secure "western-routes" link with the U.K. across the North Atlantic, America and the Pacific. In addition, now that B.O.A.C. have the capacity and the competitive equipment, there is valuable new trans-Pacific business to be gained: at the moment no passenger traffic from the Far East goes to America by British carriers—and B.O.A.C.'s application will almost certainly arouse opposition from American carriers like PanAm, Northwest and T.W.A.

Mounted as a wing-tip pod, the Honeywell-Atkins collision-avoidance light is pictured here with its inventor, William Atkins, a pilot formerly employed by Northwest Airlines and now with Minneapolis-Honeywell. Flashing strobe lights are employed

Target date for the maiden flight of the first AW.650 Argosy, seen here as it appeared last week, remains "before Christmas." A second aircraft is well advanced. Behind the scenes, A.W.'s commercial efforts to promote the aircraft are said to be yielding encouraging results

CIVIL AVIATION . . .

MILE-A-MINUTE BUS

TWO French bus operators—Les Courriers Normands and Compagnie Normande d'Autobus, both subsidiaries of the publicly-owned Société Générale des Transports Départementaux—have disclosed details of their experimental summer helicopter service between Caen and Le Havre. It functioned for five weeks from July 25 to August 31, a 15-seater Vertol 44 operating three round trips daily. The 42-mile route traversed the Seine estuary from Le Havre to Deauville, an intermediate stop being made at Honfleur, and then continued south-westwards along the coast via Cabourg and Ouistreham before cutting inland to Caen. As against this 40-minute journey the regular bus service takes 3½ hr to cover 120 miles. Comparative through fares were Fr. 5,000 by helicopter and Fr. 1,000 by bus.

The aircraft was chartered from Helicop-Air (Vertol agents in France), who also provided three pilots and four engineers. During the course of the operation the helicopter covered almost 10,000 miles in 155 hours—the low block speed (62 m.p.h.) being explained by the fact that sectors averaged only 8½ miles in length. On all scheduled services—110 round flights Le Havre - Caen and five return flights Le Havre - Deauville—the degree of regularity was almost 100 per cent. Four additional non-scheduled round flights were also operated. Load factor, which averaged 53 per cent, rose steadily from 41 per cent in the first week of operation to 61 per cent over the last fortnight.

Excluding 60 persons carried on the five non-scheduled services, the number of passengers amounted to 3,332 (a daily average of over 90), equivalent to 70,000 passenger-miles. Most of this traffic came from the neighbourhood. The low average length of haul—only 21 miles—reflects the predominance of Le Havre - Deauville traffic along the route. About 56 per cent of the passengers travelled for personal reasons, business travel accounting for only 6 per cent. The remaining 39 per cent gave "curiosity" as their motive.

Financially the operation failed to break even, despite high utilization-rates and load-factors. M. Jean Richard-Deshais, chairman of S.G.T.D. (and president of Air Algerie), has quoted the net deficit at Fr. 5-6m. On the basis of these figures the operation would only just have showed a marginal profit if all seats had been sold at the prevailing rate of Fr. 75 (about 20 pence) per passenger-mile. To make the service economic, the operators realize, the shorter sectors must be eliminated. As traffic at the smaller stations does not warrant the additional expenditure involved in operating shorter sectors, it is probable that stops at Honfleur and Ouistreham will be eliminated in the future.

BREVITIES

It is reported that South African Airways' target-date for the introduction of Viscount 810s into service is January 1, 1959.

* * *

Sir Hudson Fysh, chairman of Qantas, has been appointed vice-chairman of T.E.A.L. He has been a director since 1940.

* * *

The Federal Government of the West Indies has refused an application by Eagle Airways (Bermuda) to operate a scheduled service on the route Bermuda - Antigua - Barbados - Trinidad.

* * *

B.O.A.C.'s Stratocruisers have now been entirely withdrawn from North Atlantic service, after having been in continuous operation since December 6, 1949. According to B.O.A.C. they have made 12,700 crossings and carried 603,000 passengers.

* * *

At the Baltic Exchange on December 11 a stained glass window presented to G.A.P.A.N. by the late Capt. Alfred Instone will be unveiled. The ceremony will be followed by a reception. Applications for tickets (25s) should be made to the Secretary.

* * *

Following B.E.A.'s announcement that new low fares will be made available for inclusive-tour passengers on scheduled routes comes an Eagle statement confirming the adoption of a similar policy. Eagle's lower rates are offered on scheduled routes to Northern Italy and Austria.

* * *

A new U.S. company, General Aircraft and Leasing, has arranged to purchase 25 DC-7s from American Airlines (it will be recalled that A.A. have already disposed of 24 Convair 240s to F. B. Ayer). The new company, managed by Gen. Milton Arnold and reportedly associated with Convair, values the DC-7s at about £340,000 each.

* * *

At its meeting in Paris next January the I.C.A.O. communications division will consider the joint financing of a transatlantic cable to improve radio communications over the North Atlantic. The cable is being considered as a replacement of the V.H.F. scatter system, which is considered unlikely to meet requirements, as well as being more costly than was originally estimated.

* * *

American Airlines announce that the date for the introduction of 707s on the first transcontinental jet services (New York - Los Angeles) is January 25, 1959. The first Electra services will be introduced, between New York and Chicago, on January 23. Present indications are that National will be the first U.S. domestic jet operators; they will lease PanAm 707s for the New York-Miami route, starting December 10.

Flight records with regret the death, at 49 years of age, of Mr. Russ Baker, president of Pacific Western Airlines of Vancouver. He succumbed to a heart attack in Vancouver on November 15.

* * *

The Air Registration Board announces the issue of the following Notices to Licensed Engineers and to Owners of Aircraft: No. 36, issue 3, and No. 53, issue 1, both dated November 10.

* * *

On April 1, 1959, announces the M.T.C.A., a common examination for Commercial Pilots' Licences will be adopted. This is notified in M.T.C.A. civil aviation information circular No. 110, dated November 19.

* * *

The second Grumman Gulfstream was due to fly last week, and the third is due to fly next week. The first Gulfstream has flown 89 hours, including nine hours in one recent day. The fuselage in the water tank has been subjected to 25,000 pressurization-reversals.

* * *

Continental Air Lines speak well of their "Viscount IIs" during their first four months of service (up to September 30). Net operating profit for the period was more than $½m. "There has been no question about the attractiveness of this airplane," say Continental.

* * *

Mr. A. H. Milward, chief executive of B.E.A., flew to Jersey last week for talks about fares. An official statement referred to maintaining "the position of the Channel Islands as a major tourist resort in the face of increasing competition." It is understood that local hoteliers consider air fares to be too high.

* * *

Aer Lingus will carry out Friendship demonstrations in the United Kingdom. The first is due to take place at Manchester next Thursday, December 4. Other demonstrations will include one at Bristol on December 9 and another at London on January 14. In their latest news releases Aer Lingus are pointing out that the Friendship is "60 per cent British."

* * *

Latest move in B.O.A.C.'s efforts to see their associate B.W.I.A. on a sounder financial footing is that Sir Errol Dos Santos, B.W.I.A.'s chairman since 1950, becomes president. A successor has not yet been appointed; the deputy chairman, Mr. H. O. B. Wooding, will provisionally act as chairman. Sir Errol Dos Santos now assumes an office which Sir Gerard d'Erlanger has relinquished so that Sir Errol's "long experience and valuable counsel" may continue to be available to B.W.I.A.

ARGOSY ACCESS

MAINTENANCE DOCK FOR THE AW.650

THE use of maintenance docks is steadily growing in popularity among commercial-aircraft operators. Though the initial cost of such docks may be high in comparison with that of utilizing odd ladders, stagings and other such shop equipment which is usually already available, this objection is likely to be outweighed by the advantages. These include easy and safe access to all parts of the aircraft; saving of time which would otherwise be wasted in moving mobile equipment; avoidance of risk of damage to aircraft by mobile steps and stagings; and the avoidance of loose lines for compressed air, electricity and other services. In addition, use of a dock is likely to lead to better workmanship by reason of the more convenient working positions it affords; and in the long run the maintenance-cost may well be lower than that of odd ladders, trestles, jacks and so forth which the dock supplants.

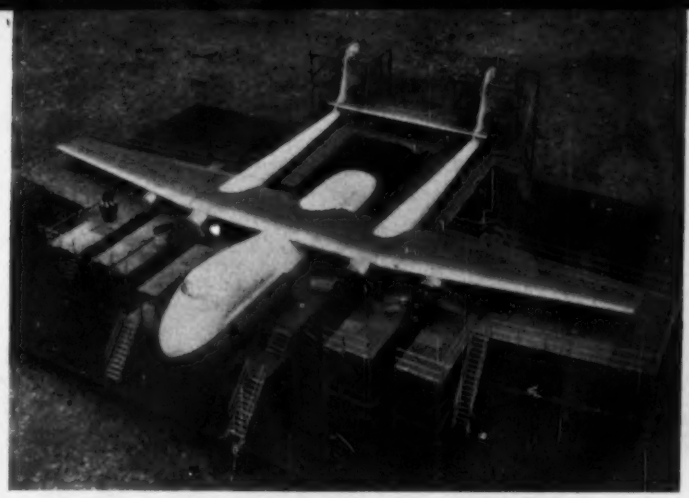
The latest of these structures to be designed is for the Armstrong Whitworth Argosy (the aircraft was described in *Flight* for October 17, 1958), and it is the work of Rodger, Setterington and Partners—who, as noted below, have already designed docks for a number of well-known aircraft types. Alternative layouts provide for either tail-first or nose-first docking of the Argosy. Though individual operators may have special reasons for choosing the latter, the tail-first method is probably the more advantageous. For instance, it permits the high tail-platforms to be designed as permanent structures, thus increasing their stability; and in the average hangar it is also likely to allow better natural lighting conditions at the nose of the aircraft. When the machine is moved in, its wings will pass over all the platforms except those giving access to the electrics bay at the top of the fuselage; but arrangements are made for these platforms to have a 2ft upward movement after the aircraft has been docked.

The main platforms round the trailing and leading edges of the main wing give access to ailerons, de-icing system, fuel tanks and other components, and they surround a well deep enough to enable operators to stand upright below the wing. These platforms also give access to the engines, hinged flaps closing flush with the floors being provided to accommodate the propellers and the undercarriage; other flaps allow rotation, or complete removal, of the propellers.

Platforms alongside the fuselage allow access to the cabin windows and also provide support for the smaller decks serving the electrics bay. These decks can also be extended forward to give easy access to the cockpit windows.

The arrangement of the tail-staging—which is reached by catwalks running along both sides of each tail boom—gives access to every part of the horizontal and vertical tail surfaces, and hinged flaps are provided to permit full operation of the rudders.

Easy access to and between decks throughout the dock is provided by steel stairways, safeguarded—like the decks themselves—by double handrailing. Gaps between adjacent levels are covered with easily removable metal sheeting to avoid the risk of operators falling through or dropping tools. The main units of the dock are designed for installation either as free-standing structures or as mobile units; and where frequent movement is likely to be required they can be provided with jacking castors. The vertical columns of the units support steel-channel frameworks on which are laid hardwood flooring that is sealed to prevent absorption of oil and other fluids.



A finely constructed model of Rodger, Setterington and Partners' dock developed for the Argosy. This is the "tail-first" version. A particular point of interest is that the dock is so designed that it can be completely dismantled and loaded into the aircraft for delivery with it

Various services can easily be piped into the dock, the most likely being compressed air at 100 lb/sq in for pneumatic tools, and electric cables for tools and any special lighting requirements. Pipes and cable-conduits are run under the fixed structure and take-off points can be located at almost any convenient position.

The nose-first docking method permits use of a large wing-and-nose platform—which could, if necessary, be extended to the hangar rear wall. As already mentioned, the tail platforms must be made mobile, though this disadvantage may be offset by the increased floor space which could be made available by parking the mobile structures in the gap between port and starboard wing platforms when the dock is not in use.

Rodger, Setterington and Partners (whose headquarters are at Western Avenue, London, W.5) have been concerned with the design and installation of aircraft docks for more than 11 years. Their designs have included Pionair, Elizabethan and Viscount docks for B.E.A., Britannia docks for B.O.A.C., and (in co-operation with the Ministry of Supply) facilities for the Valiant and Victor. The layouts are prepared to operators' requirements with a view to manufacture, erection and installation by approved contractors under the supervision of Rodger, Setterington and Partners' own engineers.

BOMBER IN BUSINESS

LATEST business-aircraft conversion to be produced by L. B. Smith Aircraft Corporation of Miami is the seven-seat Super B-26, which made its first appearance at the recent National Business Aircraft meeting in Philadelphia. The aircraft cruises at 325 m.p.h. on 60 per cent power, and has a range of 2,100 miles at a take-off gross weight of 35,000 lb. The B-26 is, of course, the Douglas Invader.

The new interior of the machine has been designed by Charles Butler Associates in a colour scheme featuring gold, wheat and tones of blue. "Cabinetry is of smooth, hand-rubbed blond walnut," a company statement reveals, and "the instrument panel and overhead panel are finished in turquoise with eyebrow-type lighting."

The L. B. Smith Super B-26 executive aircraft

CAUSES OF CORROSION

THE Corrosion and Electrodeposition Committee of the Inter-Service Metallurgical Research Council (Admiralty and M.o.S.) has produced a useful booklet entitled *Corrosion of Metals by Vapours from Organic Materials*, by Vera E. Rance and H. G. Cole (H.M.S.O., price 2s). Many of the materials and conditions dealt with are frequently encountered in aeronautical practice, and the booklet should be of particular interest to those concerned with packaging and preservation.

ABOUT TECHNICAL EDUCATION

A NEW pamphlet, *Britain's Future and Technical Education*, has been published by the Ministry of Education. It describes the five-year programme begun in 1955 for the expansion and improvement of technical colleges, and appeals to industry for further co-operation and support. Particular emphasis is placed on sandwich courses leading to the recently founded Diploma in Technology, a qualification intended to be equivalent to a university honours degree.

PUBLICATIONS ON MICROFILM

FROM University Microfilms, Ltd., Dering Yard, 67 New Bond Street, London, W.1, comes a catalogue of over 160 technical and other journals which, by arrangement with the various publishers, they have reproduced on microfilm—in some cases a single volume, in other instances volumes covering many years. *Flight*, *Aircraft Production*, and several other Iliffe journals are included. The catalogue also includes practical information on the use and storage of microfilmed material for library and other purposes.

Well known as manufacturers of display models for airlines and aircraft constructors, Westway Models, Ltd., of Brunel Road, London, W.3, were constructing Comet 1 models five years ago. Now they have "resumed Comet production" with Series 4s, of which this is a 1:24 scale example (fuselage length, 4ft 8in)

THE INDUSTRY

A general view of the new Kelvin and Hughes (Aviation) air-conditioned premises at Barkingside, Essex, showing drift-rate test equipment in the foreground. Temperature in the gyro and sextant room is thermostatically maintained at 68 deg F and the ceiling is a development of the standard Anderson aluminium suspended type, with fluorescent lighting through translucent p.v.c. sheeting. Employees wear special dust-free clothing

Versatile Test Instrument

A USEFUL new instrument operating on the eddy-current principle is the Elcotector, made by the East Lancashire Chemical Co., Ltd., of Fairfield, Manchester. It is contained in a case measuring approximately 12in × 8in × 8in, with mains connection and transformer tappings arranged for four A.C. voltages from 100-115 to 240-250.

The manufacturers cite a number of typical applications. The Elcotector, they say, will (1) measure any type of coating, metallic or otherwise, on a ferrous base; (2) measure non-metallic coatings on most metal bases and some metallic coatings provided the specific resistance of the coating and the base is different; (3) compare the degree of hardness of steel components; (4) differentiate between the variations in ferrous contents in steel; (5) measure the thickness of non-ferrous foils; (6) measure any type of metallic or non-metallic film provided that in the latter case a metal plate can be introduced at the reverse side at the point of measurement; (7) differentiate between various types of alloys; and (8) perform the duty of a surface-crack detector.

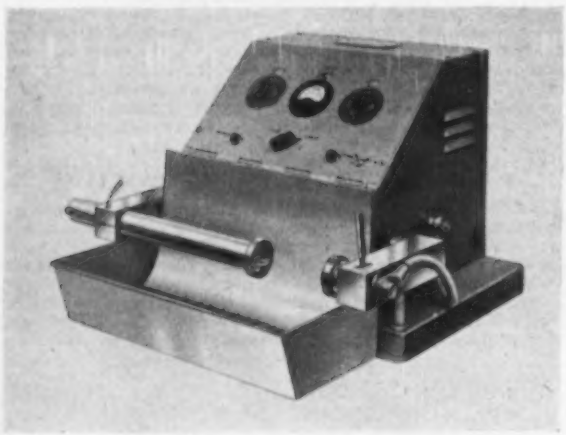
New Reinforced-plastics Process

FOR the past five years a Californian firm, the Raymond De-Icer and Engineering Co., has been developing a method of weaving three-dimensional shapes—as required, for example, in the production of radomes and missile nose-cones—in reinforced plastic materials. They appear to have achieved considerable success, and have protected their process by world patents. It is now announced that European rights for production of three-dimensional fabrics under licence have been granted to Fothergill and Harvey, Ltd., of Harvester House, Peter Street, Manchester.

In the weaving process the shape of the component is controlled by a punched-card system. The fabric is woven in flattened tubular form, the width diminishing as the apex is approached. Should a diminishing wall-thickness be required, fabrics of progressively changing thickness can be woven.

The process is not confined to the production of simple conical shapes; almost any shape of changing or non-symmetrical form can be woven; for example, a radar aerial now being produced in the U.S.A. has a parabolic curve with a flat face. Hemispheres of 12ft diameter have been produced, and even larger sizes are envisaged. Emphasis is placed on the close control of dimensional accuracy and dielectric properties that can be achieved.

Designed for production inspection of components up to 16in long, this is a typical magnetic flaw-detector in the range made by Radalloyd, Ltd., Glen Road, Oadby, Leicester. Though occupying only some 4 sq ft of bench space, it has an output of up to 1,200 amp, giving over 700 oersteds of flux through a 2in air gap. This high power makes it possible for long work-pieces (e.g., crankshafts or engine-bearers) to be handled, for which purpose cables, clamps and a separate magnetizing coil can be supplied as additional accessories



IN BRIEF

Four members of the staff of Wolf Electric Tools, Ltd., have recently been elected to the Board. They are Mr. N. McCann (secretary and director); Mr. R. G. J. Nisbet (director of Canadian operations); Mr. J. A. Jackson (works director); and Mr. W. N. Scottorn (sales director).

Mr. Kenneth J. McDonald, O.B.E., D.F.C., appointed manager of commercial aircraft sales for Canadair, Ltd. In his new appointment Mr. McDonald (since the beginning of 1958 assistant to the company's director of sales) will be responsible to Mr. Karl H. Larsson, director of the commercial aircraft department of the sales division. He joined Canadair a year ago after retiring from the R.A.F. (in which he had served for 21 years) with the rank of group captain. During the war he served with No. 78 Sqn. and commanded No. 90 Sqn.

With the title *Rocol Molybdenised Lubricants* a booklet has been published by Rocol, Ltd., of Rocol House, Swillington, nr. Leeds, and Ibex House, Minories, London, E.C.3, describing the full range of specialised lubricants developed by the company on the basis of molybdenum disulphide.

* * *

From R. B. Pullin and Co., Ltd., Phoenix Works, Great West Road, Brentford, come details of the new Pullin PM1C, a D.C. permanent-magnet motor rated at 80 gm/cm at 5,000 r.p.m. It is a modified version of the PM1 motor but with improved climatic endurance and life of over 1,000 hr under continuous operation.

* * *

The airborne profile recorder produced by Canadian Applied Research, Ltd., of Toronto, has successfully completed operational tests in U.S.A.F. Lockheed RC.130 aircraft which are to carry out a world mapping programme. The average accuracy of ±10ft at heights up to 35,000ft was confirmed. The U.S.A.F. survey will be flown by 15 RC-130s of the 1370th Air Photographic Group based at Palm Beach, Florida.

DESTINATION APOGEE!

ARMSTRONG SIDDELEY ROCKET MOTOR SENDS BLACK KNIGHT TO 'SPUTNIK HEIGHT' ON FIRST TEST

ARMSTRONG SIDDELEY, who developed and produced the power unit for Black Knight, are proud to have been associated with the Saunders-Roe Company and the Royal Aircraft Establishment in the successful first launching of Britain's research rocket. Black Knight is designed to reach a maximum height — or Apogee, as the scientists call it — of several hundred miles above the earth's surface — ultimately to 1,500 miles. Armstrong Siddeley is in the forefront of rocket research and development, and the company's new gas turbine and rocket research station is equipped to deal with any demands that may be made in the foreseeable future.

Bristol Siddeley

ENGINES LIMITED

FLIGHT and AIRCRAFT ENGINEER

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PRESS DAY—*Classified advertisement "copy" should reach Head Office by* **FIRST POST THURSDAY** *for publication in the following week's issue subject to space being available.*

Advertisement Rates. 5/- per line, minimum 10/-, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Public Appointments, Tenders 6/- per line, minimum 12/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

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DOUGLAS D.C.3. Low time since major. Full air line standard. £19,000.
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LOCKHEED 049 CONSTELLATIONS. Fleet available from $350,000.
LOCKHEED CONSTELLATION. 749 and 1049 also available.
VICKERS VIKING. Long nosed aircraft, excellent condition. Full air line standards. £23,000 each.
DOVES. Several available from £11,500.

THE above transport aircraft for sale through our offices represent the best values on the world market today. Full details sent on request.

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AUSTER J.4. Engine hours since overhaul, 200 (800 hour life). Excellent condition. C. of A. till August 1959. £850.
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CHIPMUNK. Another of these delightful aircraft, at a most attractive price.
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IN recent weeks we offered a 1953 model flown by us from Mexico—sold; a 1955 model in New York—sold. Now, remarkably enough, we are able to offer another 1953 4/6 V.I.P. D.H. Dove, 800 hours total, for £10,850.
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WE can fly it across, and can consider offers delivered, with British C. of A. If you are interested, we recommend you to advise us quickly.
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DE HAVILLAND HERONS in immaculate condition. Full airline radio, de-icing, 14/17 seats, toilet.
BRISTOL 170, Mk.31E. Fully equipped. 46 seats. All modifications incorporated.
DEFERRED terms. Part exchanges. Spares.

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This Bristol 170 Mk. 21 is owned by Monsieur Boussac, and has 3,526 hours on the airframe. Hercules 672 engines with 325 and 799 hours run, and PD.96/446/2 propellers with 197 hours since complete overhaul.

Only 2,123 landings have been completed since new, leaving 2,377 landings before the spar mods. are due.

A Sperry auto pilot is fitted, and the radio consists of ARC-1, 50 channel V.H.F.; BC.347, HF/MF; 75 m/cs marker receiver; SCR.269G, ADF.

The aircraft is equipped as a Freighter with bare interior, and is offered for immediate delivery in "as is" condition ex Hurn Airport. As the owner is anxious to dispose of this aircraft before the end of the year, any reasonable offer will be considered.

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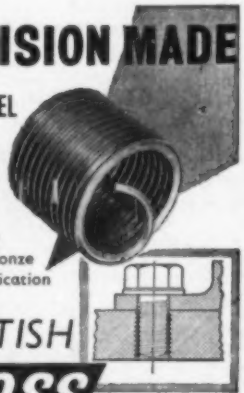

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ANNOUNCE that, consequent upon the purchase of Viscounts 831, their two Viscounts 736, are available for sale for delivery in April, 1959, together with ample spares, including engines and propellers, to enable the purchaser to operate them immediately.
THE aircraft are offered with nil hours after Check 4 having completed 6,000-6,500 hours since new and will be upholstered to the Buyer's requirements.
APPLICATIONS should be addressed to Aircraft Sales Manager, Airwork Limited, 35 Piccadilly, London, W.1. [8528

SIKORSKI S.51 Helicopter—Pratt & Whitney 985 engine. Very low hours. Would consider long term hire. Box No. 0438. [8506
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FLEET of four D.H. Dove aircraft Gipsy 70/4 engines, together with comprehensive spare holding. Hire purchase terms arranged. Further details apply Channel Airways, Southend Airport, Essex. [0031
AVRO XIX, excellent condition throughout, economical executive aircraft. Cheetah 17 engines, V.P. fully feather propellers. Airframe only 1,100 hours since new. Dual control, 7 passenger seats, long range tank fitted, 2 extra seats available. STR 12 A 50 channel VHF. Bendix Radio Compass, Fan Marker. C. of A. valid until July 1959. £4,000 or best offer. G. Farley, Lec Refrigeration, Ltd., Bognor Regis. [8507

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CONSUL, Aerovan or Anson (with wooden wing) requested urgently, must have low engine hours, blind flying equipment, navigation lights, V.H.F. and full C. of A. Offers to: Aero-Nord n.v. Schrijnwerkerstraat, 9, Antwerp, Belgium. [8495

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PHILLIPS AND WHITE, LTD., offer from stock instruments and instrument parts. Navigational equipment, electrical components, airframe parts and hydraulic components and parts. Engine spares for de Havilland Gipsy Major and Queen series, also Armstrong Siddeley Cheetah IX, X and XV spares. 61 Queen's Gardens, London, W.2. Tel.: Ambassador 8651, 2764. Cables: Gyrair, London. [0466
ENGINE Overhauls. Hants and Sussex Aviation, Limited, offer Britain's most comprehensive complete overhaul service, magneto overhaul service and components and spares supply. Specializing in all de Havilland and Gipsy range including Queen 30 series. United Kingdom distributors of Continental and agents for Lycoming. Also provide full cover for Cirrus range and Cheetah series. Most types available on exchange. Engines, Components and Spares shipped to all parts of the world. Address: The Airport, Portsmouth, Hants. Tel.: 63051. [0711

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LEARN to fly this winter, ready for next season's soaring. Weekly courses for beginners, also Olympia conversions. November to March from £12 12s. inclusive. Short part-week courses sometimes possible Nov. to Feb. Send S.A.E. to Dept. 2, Lasham Gliding Centre, Alton, Hants. [0570

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned application to operate a scheduled air service:—

FROM Skyways, Ltd., of 7 Berkeley Street, London, W.1, for a Normal Scheduled Service with York and Hermes aircraft for the carriage of passengers, supplementary freight and mail on the route London (Stansted) - Tunis - Malta at a frequency of one return flight weekly for ten years from date of approval, to be integrated with their Colonial Coach Service on the route London (Stansted) - Malta - Cyprus.

THIS application will be considered by the Council under special Terms of Reference contained in a letter to them from the Minister of Transport and Civil Aviation dated 7th November, 1958. Any representations or objections with regard to this application must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the application and copies of the special Terms of Reference may be obtained. [8523

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Films available. K24, N24, F52, K8AB and other cameras and all accessories available from stock. We purchase all types of aircraft cameras, lenses, and equipment appertaining to photography.
Write:— Air Survey Dept.
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TO B.S. SPECIFICATION S.P.47
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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Airwork, Ltd., of Blackbushe Airport, Camberley, Surrey, and from Hunting-Clan Air Transport, Ltd., of London Airport, Hounslow, Middlesex:—

APPLICATION No. 1462/2 and Application No. 1456/2 respectively, for an increase of ten return flights per annum in the joint frequency of the Normal Scheduled Services which they are at present authorised to operate with Viscount aircraft on the route London - Lisbon - Las Palmas - Dakar - Bathurst - Freetown - Takoradi (opt) - Accra at a joint frequency of four return flights each 28 days until 31st December, 1967.

FROM East Anglian Flying Services, Ltd., of Southend Airport, Essex:—

APPLICATION No. 452/4 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate on the route Ipswich and/or Southend - Rotterdam at a frequency of 30 return flights weekly with D.H.89, Dove, Heron and Bristol 170 aircraft subject to the operation of not more than two return flights daily with Bristol 170 aircraft and subject also to a maximum daily passenger capacity of 122 seats, so as to permit the operation of Viking aircraft in addition to the types already approved and to convert the daily passenger restriction into a weekly maximum of 854 seats.

FROM Silver City Airways, Ltd., of 62 Brompton Road, London, S.W.3:—

APPLICATION No. 94/4 for an optional traffic stop Leeds (Yeadon) on the Normal Scheduled Service which they are at present authorised to operate with Dakota, Bristol 170 and Heron aircraft on the route Newcastle - Amsterdam - Dusseldorf at a frequency of seven return flights weekly until 31st March, 1960.

FROM Eagle Airways, Ltd., of 40, Edgware Road, London, W.2:—

APPLICATION No. 2352 for a seasonal Normal Scheduled Service with Viking, Viscount, DC6A/B and Heron aircraft for the carriage of passengers, supplementary freight and mail between Manchester (Ringway) and Rotterdam at an initial frequency of seven return flights weekly increasing later to 14 return flights weekly from April to October each year for 10 years from date of approval.

FROM Derby Aviation, Ltd., of Derby Airport, Burnaston, Nr. Derby:—

APPLICATION No. 2324 (amended) for a Normal Scheduled Service initially with Dakota aircraft and later also with Herald aircraft for the carriage of passengers, supplementary freight and mail on the route Manchester and/or Derby and/or Birmingham - Lyons (tech) - Albenga (opt) - Genoa (Christopher Columbus) at an initial frequency of two return flights weekly increasing later to four return flights weekly for seven years from 1st May, 1958.

FROM Overseas Aviation (C.I.), Ltd., of 29 Hill Street, St. Helier, Jersey, C.I., for the following Normal Scheduled Services with Viking and Argonaut aircraft for the carriage of passengers and supplementary freight at an initial frequency of two return flights weekly on each service increasing later to seven return flights weekly for seven years from date of approval:—

Application No. 2358 on the route Liverpool (Speke) - Beauvais - Genoa (Christopher Columbus).
Application No. 2359 on the route Liverpool (Speke) - Southend or London (Gatwick) (tech) - Geneva.
Application No. 2360 on the route Liverpool (Speke) - Southend or London (Gatwick) (tech) - Basle.

FROM Skyways, Ltd., of 7 Berkeley Street, London, W.1:—

Application No.2361 for permission to operate the following services from Lympne and/or Manston instead of from Lympne only:—

NORMAL Scheduled Services:—

Application No. 310: Lympne - Beauvais.
Application No. 792: Lympne - Vichy and/or Valence (or Lyons for Valence) and Lympne - Vichy and/or Montpellier.
Application No. 1573: Lympne - Tours.
Application No. 1577: Lympne - Dijon.

INCLUSIVE Tour Services:—

Application No. 2224: Lympne - Dijon.
Application No. 2225: Lympne - Lyons.
Application No. 2226: Lympne - Montpellier.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [8522

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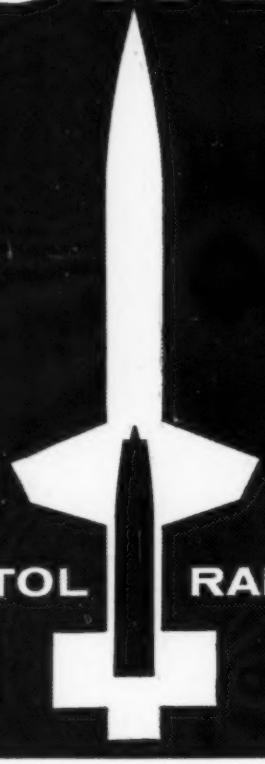

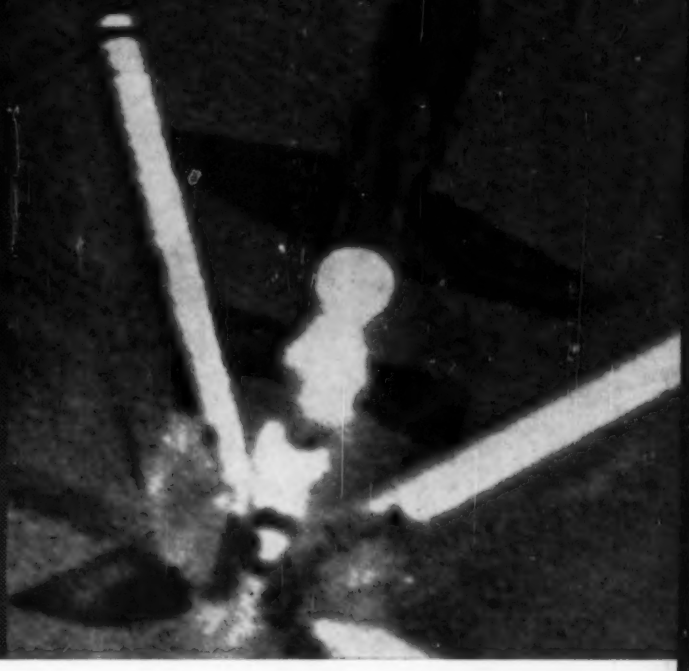

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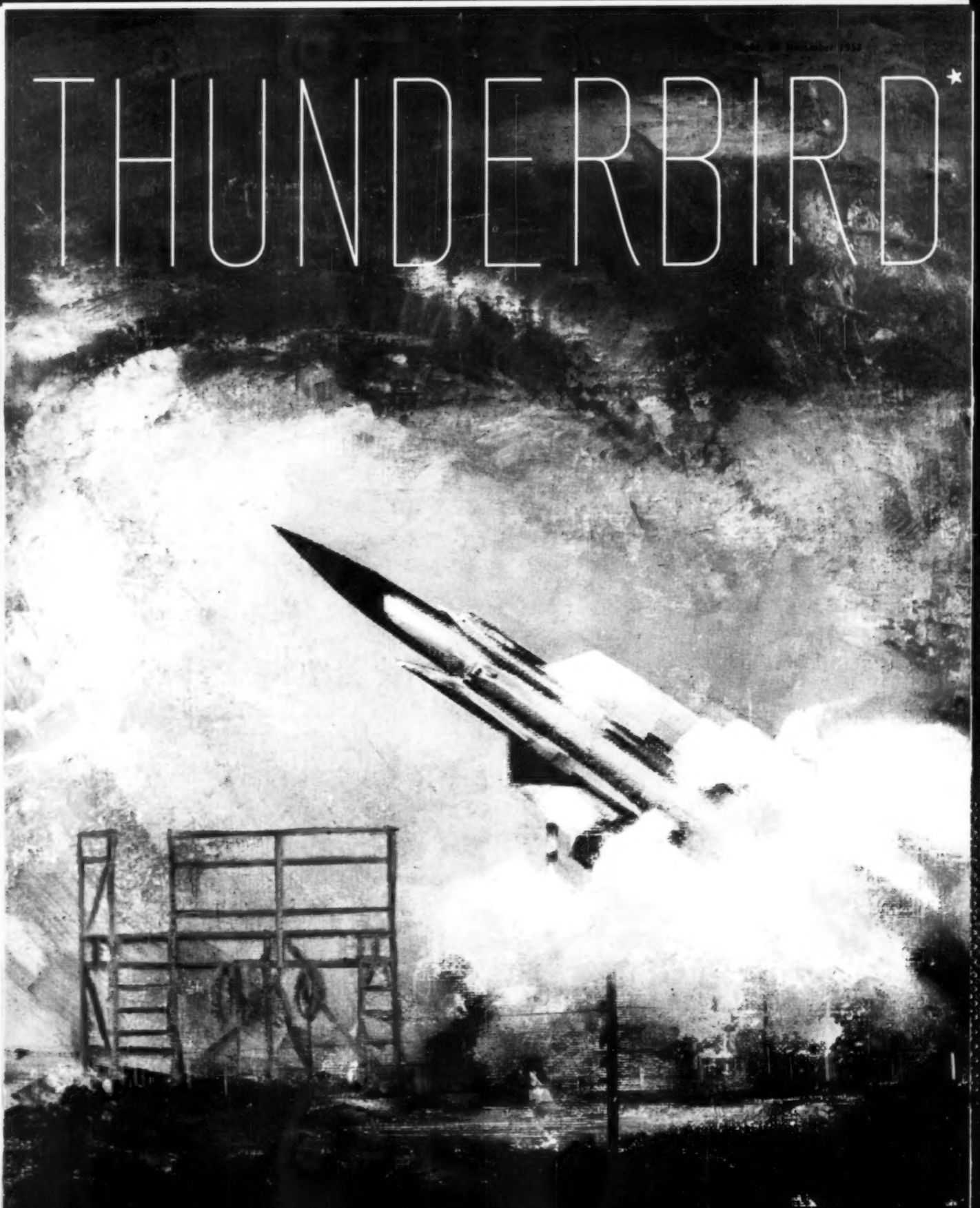

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